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49TH CONGRESS, } HOUSE OF REPRESENTATIV
2d *Session.* }

ANNUAL REPORT

OF THE

CHIEF OF ENGINE

UNITED STATES ARMY,

TO THE

SECRETARY OF WAR,

FOR

THE YEAR 1886.

IN THREE PARTS.

PART II.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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ERRATA FOR ANNUAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY, FOR 1886.

Page 541.—Heading Improvement of navigation in the Back Cove, Portsmouth Harbor, New Hampshire, should read— Improvement of navigation in the channel of Back Cove, Portland, Maine.

Page 555.—In estimate, fourth line, change $2 to $1

Page 1161.—First line, after the word presumably, insert interested

Page 1165.—Fourth line from bottom, change 30 feet to 80 feet

Page 1171.—Paragraph 2, first line change 1870 to 1876,

Page 1176.—Seventh line from bottom, change 4 to 5

Page 1208.—Fifteenth line from bottom, change $15,154.83 to $15,164.83.

Page 1230.—Third paragraph from bottom, third line, change those short crises to three short rises

Page 1231.—Second table, 6th column, box heading, 29 feet should be 26 feet
First table, 9th column, box heading 29 feet should be 26 feet

Page 1246.—Ending fourth paragraph insert, Major Stickney in his report of 1884, saying "the detailed plans for locks not being completed, no new estimate is presented, but it is probable that the cost of such locks as are deemed suitable for the work will increase the estimate somewhat."

Page 1252.—End of fourteenth line, change 0.0 feet to 0.05 feet
Fifteenth line, change 8.5 to .85
Twenty-first line, change 25 to .25

Page 1257.—Last paragraph, second line, change 74.07 to 7,407

Page 1258.—Ninth line, change feet to inch

Page 1263.—To follow improvement of bayou Courtableau, Louisiana, insert:

Appropriations for this work have been as follows:

June 14, 1880	$7,500
March 3, 1881	7,500
July 5, 1884	4,000
Total	19,000.

Page 1267.—Fifth paragraph, third line, change $100,000 to $109,000;

Page 1274.—Fifth paragraph, second line, change instrument to investment.

Page 1277.—Fourth paragraph, eleventh line, be subjected should be not subjected.

Page 1278.—Fourth paragraph, sixth line, change 188.40 to 10,840
Eighth paragraph, seventh line, change rest to crest

Page 1279.—Sixth paragraph, fourth line, change 664,364 to 66,436.4

Page 1283.—For last paragraph insert:

Generally considered there has been a deepening since 1881 of from 1 to 2½ feet over the whole area between the jetties, the greatest scour having taken place in the deepest water. The improvement in depth has extended for a distance of 2,000 feet beyond the end of the east jetty, though to a less degree than within. Beyond this there is a small area where no change has occurred, while beyond this again there has been a shoaling of four-tenths of a foot in the line of the channel and out to a depth of 12 feet.

Behind the west jetty the water has shoaled from 1 to 4 feet, the greatest shoaling being found near the shore. From a point 1,000 feet beyond the "Clifton" and between the new channel and the foundation of the west jetty, laid in 1883, there has been a shoaling which extends out to the 12-foot depth. The decrease in depth is greatest near the jetty, and diminishes gradually toward the eastward. The bottom over this area is hard sand, and it is evident that the shoaling has been due to the banking up of the westerly sand-drift against the west jetty; for in 1884 this sand bottom was found to extend 1¼ miles to the eastward of the west jetty, while now sand is only found in isolated spots farther to the eastward than 1,800 feet from the west jetty, and at certain points it completely covers the foundation and has overflowed to the west of the jetty.

Page 1284.—Omit paragraph (second from bottom) beginning with I west jetty, &c.

Page 1287.—Fourth paragraph, second line, change 700 to 7,00

Page 1325.—Fifth and sixth lines, change $14,451 to $14,541

Page 1327.—Four lines from bottom, change 720 to 750

Page 1329.—Fourth paragraph, fourth line, change 4,027,636 to
Fourth paragraph, seventh line, change 14,566,616 to 1

Page 1332.—Fifth paragraph, third line, change station No. 1 to No. 4

Page 1334.—Under heading Improvement of Harbor at Brazos Santiag change appropriated 1885–'86 to appropriated 18

Page 1341.—Paragraph next to the last, second line, change 1885 to

Page 1342.—Fortieth line, change 727,049.10 to 725,049.10

Page 1344.—Paragraph 2, tenth line, change drains to draws

Page 1345.—Paragraph 6, sixteenth line, change 1879 to 1877

Page 1358.—Under commercial statistics, after the words lumber and tim B. M., change 100,000 to 1,100,000

Page 1363.—Six lines from bottom, change 1880 to 1883.

Page 1372.—Paragraph 5, eleventh line, change two hundred and th to three hundred and twenty

Page 1400.—Paragraph 5, last line, change $12,000 to $2,000.

Page 1421.—Above money statement insert:

ABSTRACT OF APPROPRIATIONS.

By act approved June 18, 1878	$
By act approved March 3, 1879[*]	
By act approved June 14, 1880	
By act approved March 3, 1881	
By act passed August 2, 1882	
By act approved July 5, 1884	
Total	1,

Page 1422.—Eleventh line from bottom change 4 to 3

Page 1447.—Third paragraph, ninth line, change 1854 to 1864,

Page 1451.—Sixth paragraph, sixth line, after cubic yard insert

Page 1455.—Last paragraph, first line, change Dutch to Duck

Page 1461.—First table, fifth column, opposite 1880, insert $4
First table, sixth column, opposite 1880, change $52,052.00 $6,052.00

Page 1462.—Second table, second column, fifth line, change 6,397.50 3,697.50

Page 1463.—Under the head of *Comparison of estimates*, &c., eighth column line, change 8,968.98 to 8,986.98

Page 1491.—Immediately above the last line insert expended duri fiscal year ending June 30, 1886, including outstanding lia $2,469.46.

Page 1551.—Contract was awarded to John J. Shipman, and was execute date of September 26, 1885, transpose to precede A A 12.

Page 1594.—Fourth paragraph, second line, change Dano to Dan

Page 1595.—Eighth paragraph after Schoonmaker change chief to
Eighth paragraph, end of fourth line, insert the
Second paragraph from bottom, second line, after guard crib

Page 1596.—To follow seventh paragraph: The following is from the recor at the lock for the year.
Ninth paragraph from bottom, second line, between the words the insert till
Fifth paragraph from bottom, second line, change lowerin lowered

Page 1597.—Fifth line, change 2,426,300 to 3,426,300
Seventh paragraph from bottom, third line, after the word a insert of importance

Page 1598.—Fourth paragraph, first line, change belted to bolte
Fifth paragraph, first line, change Kiolin to Kirlin
Beginning seventh paragraph, change for several to several

Page 1613.—Last line, change 73.2 to 32.7

Page 1614.—Second paragraph, second line, after the word water
It was maintained 250 days to lock No. 5, and was suspe days by ice and high water,

---

[*] Twenty thousand dollars set aside for testing Adam's Flume.

Page 1614.—Fifth paragraph, third line, between the and lowest insert next to the

Page 1620.—Third table, fourth column, first line, change $744,400 to $774,400

Page 1635.—Eighth paragraph, fifth line, change $5,726.52 to $6,726.52.

Page 1638.—Fourth paragraph, fourth line, insert feet after 6 and inches after 12

Page 1697.—Last paragraph, first line, change 2.8 inches to 2 feet 8 inches

Page 1705.—Between twenty-fifth and twenty sixth lines insert Coal shipped out by rail, cars 2,400

Page 1762.—Last paragraph, first line, change 1886 to 1866.

Page 1764.—In first paragraph, under heading "Improvement of Muskegon Harbor, Michigan," change the word stream to channel in first line.

Page 1767.—Fourth paragraph from bottom, third line, change 45 to 4.5

Page 1768.—Third paragraph from bottom, last line, after 1868, insert 1869, end crib and after condition insert 123 feet crib work of irregular width built previous to 1866, re-superstructured in 1884, in good condition, and 46 feet of crib work 20 feet wide, built in 1868, re-superstructed in 1884, in good condition.

Page 1769.—Eighth paragraph, change 1886 to 1866

Page 1774.—Second paragraph, fourth line, change 90 feet to 30 feet

Page 1778.—Ninth paragraph, fourth line, after the words paid for insert leaving 46,527 cubic yards which was paid for

Page 1781.—Under Money Statement, tenth line, to follow project, insert modified as proposed

Page 1783.—In second table, third box-heading, Hercules powder, change 1,000 pounds to 4,000 pounds.

Page 1792.—Next to last line, change 1856 to 1855,

Page 1794.—Second paragraph, third line, change 1866 to 1868
Fourth paragraph, seventh line, change the slopes to side slopes

Page 1796.—Eighth paragraph, second line, change 1881 to 1871

Page 1801.—Third paragraph, second line, change constructed to obstructed

Page 1802.—Fifth paragraph, seventh line, after practically insert completed

Page 1823.—Sixth line from bottom, change 223,872 to 323,872

Page 1824.—Fourth line from bottom, change 58,000 to 85,000

Page 1833.—Second table, abstract of bids for supplies opened April 2, 1886, should be as follows:

Abstracts of bids for supplies required for the harbor of refuge, Lake Huron, received and opened by Lieut. Col. O. M. Poe, Corps of Engineers, on April 2, 1886, in accordance with advertisement dated March 23, 1886.

No.	Names and residences of bidders.	Painters' supplies.	Ship chandlery.	Hardware.
1	H. D. Edwards & Co., Detroit, Mich *	$45 81		
2	Farr and Williams & Co., Detroit, Mich	50 36		
3	J. P. Donaldson & Co., Detroit, Mich	52 10		
4	T. H. Hinchman & Son, Detroit, Mich	54 20		
5	James E. Davis & Co., Detroit, Mich	54 02		
1	H. D. Edwards & Co., Detroit, Mich *		$189 45	
2	J. P. Donaldson & Co., Detroit, Mich		198 50	
1	James L. Fisher, Detroit, Mich *			$42 35
2	T. B. Rayl & Co., Detroit, Mich			44 50

* Recommended for acceptance.

Page 1836.—Fourth paragraph from bottom, change 20,000 to 20

Page 1860.—Seventh paragraph, second line, change $114,133.64 to $114,183.64

Page 1872.—In abstract of contract, second column, third, fourth, and fifth lines, between the words per and foot insert M

Page 1884.—Under second heading Commercial Statistics, amount of revenue collected should be $156,663.71

Page 1891.—Sixth paragraph from bottom, fourth line, change 1886 to 1885,
Fourth paragraph from bottom, change 500 to 568

Page 1893.—Third paragraph, fourth line, after pier head insert in 1869

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1501; surveys for reservoirs at the sources of the Mississippi, Saint Croix, Chipp
and Wisconsin rivers, 1507.

APPENDIX Z.

REPORT OF LIEUT. COL. J. W. BARLOW, CORPS OF ENGINEERS.

IMPROVEMENTS.—Tennessee River, 1509; Cumberland River, 1515; Hiawassee River, 1519; French Broad River, Tenn., 1520; Clinch River, Tenn., 1521; Duck River, Tenn., 1523; Caney Fork River, Tenn., 1523; Little Tennessee River, Tenn., 1524; South Fork Cumberland River, Ky., 1525.

APPENDIX A A.

REPORT OF LIEUT. COL. WILLIAM E. MERRILL, CORPS OF ENGINEERS, BVT. COL., U. S. A.

IMPROVEMENTS.—Ohio River, 1528; Operating and care of Davis Island Dam, Ohio River, 1540; Monongahela River, W. Va. and Penn., 1542; Operating and care of Lock and Dam No. 9, Monongahela River, 1543; Allegheny River, Pa., 1544; Dam at Herr's Island, Allegheny River, 1545; ice-harbor at mouth of Muskingum River, Ohio, 1546; Muskingum River, Ohio, 1547; operating and care of locks and dams on the Muskingum River, Ohio, 1548; harbor of refuge near Cincinnati, Ohio, 1549; harbor of refuge at mouth of Great Kanawha River, W. Va., 1550.

EXAMINATION AND SURVEY.—Muskingum River, Ohio, 1551.

APPENDIX B B.

REPORT OF MAJ. AMOS STICKNEY, CORPS OF ENGINEERS.

IMPROVEMENTS.—Falls of the Ohio River at Louisville, Ky., 1569; Indiana Chute, Falls of the Ohio River, 1572; Louisville and Portland Canal, 1574; Wabash River, Ind. and Ill., 1582; White River, Ind., 1586.

APPENDIX C C.

REPORT OF LIEUT. COL. WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS.

IMPROVEMENTS.—Great Kanawha River, W. Va., 1589; Elk River, W. Va., 1598; New River, from the mouth of Wilson, in Grayson County, Va., to the mouth of Greenbrier River, W. Va., 1599.

APPENDIX D D.

REPORT OF CAPT. JAMES C. POST, CORPS OF ENGINEERS.

IMPROVEMENTS.—Kentucky River, Ky., 1603; operating and keeping in repair locks and dams on the Kentucky River, Ky., 1610; Tradewater River, Ky., 1617; Big Sandy River, W. Va. and Ky., 1618; Guyandotte River, W. Va., 1622; Little Kanawha River, W. Va., 1623; Buckhannon River, W. Va., 1624.

APPENDIX E E.

REPORT OF MAJ. CHARLES J. ALLEN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Harbor at Duluth, Minn., 1627; dredging Superior Bay, Wis., 1632; harbor at Grand Marais, Minn., 1637.

APPENDIX F F.

REPORT OF CAPT. CHARLES E. L. B. DAVIS, CORPS OF ENGINE

IMPROVEMENTS.—Ontonagon Harbor, Mich., 1641: Eagle Harbor, Mich., 16
quette, Harbor, Mich., 1645; harbor of refuge at Grand Marais, Mich., 164
istique Harbor, Mich., 1649; harbor at mouth of Cedar River, Mich., 165
monee Harbor, Mich. and Wis., 1652; Oconto Harbor, Wis., 1653; Pensau
bor, Wis., 1656; Green Bay Harbor, Wis., 1658; harbor of refuge at ent
Sturgeon Bay Canal, Wis., 1660: Ahnepee Harbor, Wis., 1662; Kewaunee
Wis., 1663; Two Rivers Harbor, Wis., 1665; Manitowoc Harbor, Wis., 16
boygan Harbor. Wis., 1670; Port Washington Harbor, Wis., 1672.
SURVEY.—Ashland Harbor, in Ashland Bay, Lake Superior, 1674.

APPENDIX G G.

REPORT OF CAPT. W. L. MARSHALL, CORPS OF ENGINEERS

IMPROVEMENTS.—Harbor of refuge, Milwaukee Bay, Wis., 1679; Milwaukee
Wis., 1680; Racine Harbor, Wis., 1682; Kenosha Harbor, Wis., 1684; Wa
Harbor, Ill., 1685; Fox and Wisconsin rivers, Wis., 1686.

APPENDIX H H.

REPORT OF MAJ. W. H. H. BENYAURD, CORPS OF ENGINEERS

IMPROVEMENTS.—Chicago Harbor, Ill., 1701; Calumet Harbor, Ill., 1704;
River, 1705; Calumet River, 1707.
SURVEYS.—For Hennepin Canal, 1708.

APPENDIX I I.

REPORT OF CAPT. D. W. LOCKWOOD, CORPS OF ENGINEERS.

IMPROVEMENTS.—Charlevoix Harbor, Mich., 1755; Frankfort Harbor, Mich.,
harbor of refuge at Portage Lake, Mich., 1758; Manistee Harbor, Mich.,
Ludington Harbor, Mich., 1761; Pentwater Harbor, Mich., 1762; White
Harbor, Mich., 1762; Muskegon Harbor, Mich., 1764; Grand Haven Harbor,
1766; Grand River, Mich., 1767; Black Lake Harbor, Mich., 1768; Saugatuc
bor, Mich., 1769; South Haven Harbor, Mich., 1770; Saint Joseph Harbor,
1771; Michigan City Harbor, Ind., 1774.

APPENDIX J J.

REPORT OF LIEUT. COL. O. M. POE, CORPS OF ENGINEERS, BVT. GEN., U. S. A.

IMPROVEMENTS.—Hay Lake Channel, Saint Mary's River, Mich., 1777; Saint
Falls Canal and River, Mich., 1783; operating and care of Saint Mary's Falls
Mich., 1809; dry-dock at Saint Mary's Falls Canal, Mich., 1823; harbor at Ch
gau, Mich., 1824; harbor at Thunder Bay, Mich., 1825; harbor at Au Sable,
1825; Saginaw River, Mich., 1826; harbor of refuge, Sand Beach, Lake H
Mich., 1829; steam launch or tug for harbor of refuge, Lake Huron, Mich.,
ice-harbor of refuge at Belle River, Mich., 1837; general repairs and renew
Saint Clair Flats Ship Canal, Mich., 1837; operating and care of Saint Clair
Canal, Mich., 1838; Clinton River, Mich., 1842; Detroit River, Mich., 1842.

APPENDIX K K.

REPORT OF MAJ. L. COOPER OVERMAN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Monroe Harbor, Mich., 1847; Toledo Harbor, Ohio, 1849; Port Clinton Harbor, Ohio, 1854; Sandusky City Harbor, Ohio, 1855; Sandusky River, Ohio, 1857; Huron Harbor, Ohio, 1858; Vermillion Harbor, Ohio, 1859; mouth of Black River, Ohio, 1861; Rocky River, Ohio, 1862; Cleveland Harbor, Ohio, 1863; Fairport Harbor, Ohio, 1868; Ashtabula Harbor, Ohio, 1871; Conneaut Harbor, Ohio, 1873; Dunkirk Harbor, N. Y., 1874; removing sunken vessels or craft obstructing or endangering navigation, 1876.

APPENDIX L L.

REPORT OF CAPT. EDWARD MAGUIRE, CORPS OF ENGINEERS.

IMPROVEMENTS.—Erie Harbor, Pa., 1879; Buffalo Harbor, N. Y., 1881; Niagara River, N. Y., 1884; Wilson Harbor, N. Y., 1885; Olcott Harbor, N. Y., 1885; Oak Orchard Harbor, N. Y., 1886; Charlotte Harbor, N. Y., 1887; Pultneyville Harbor, N. Y., 1889; Great Sodus Harbor, N. Y., 1890; Little Sodus Harbor, N. Y., 1891; Oswego Harbor, N. Y., 1892; Sackett's Harbor, N. Y., 1894.

APPENDIX M M.

REPORT OF MAJ. M. B. ADAMS, CORPS OF ENGINEERS.

IMPROVEMENTS.—Ogdensburg Harbor, N. Y., 1895; Grass River at Massena, N. Y., 1898; Breakwater at Rouse's Point, Lake Champlain, N. Y., 1899; Swanton Harbor, Vt., 1901; Plattsburg Harbor, N. Y., 1902; Burlington Harbor, Vt., 1903; Otter Creek, Vt., 1905; Ticonderoga River, N. Y., 1905.

APPENDIX N N.

REPORT OF LIEUT. COL. G. H. MENDELL, CORPS OF ENGINEERS, BVT. COL., U. S. A.

IMPROVEMENTS.—Oakland Harbor, Cal., 1907; Wilmington Harbor, Cal., 1911; Redwood Harbor, Cal., 1914; removal of sunken vessels or craft obstructing or endangering navigation, 1915.

APPENDIX O O.

REPORT OF COL. C. SEAFORTH STEWART, CORPS OF ENGINEERS.

IMPROVEMENT.—Harbor at San Diego, Cal., 1917.

APPENDIX P P.

REPORT OF CAPT. A. H. PAYSON, CORPS OF ENGINEERS.

IMPROVEMENTS.—Humboldt Harbor and Bay, Cal., 1919; San Joaquin River, Stockton and Mormon sloughs, Cal., 1921; Mokelumne River, Cal., 1924; Sacramento and Feather rivers, Cal., 1926; Colorado River, Nev., Cal., and Ariz., 1929.

APPENDIX Q Q.

REPORT OF MAJ. W. A. JONES, CORPS OF ENGINEERS.

IMPROVEMENTS.—Columbia and Willamette rivers below Portland, Oreg., 1938; Upper Willamette River, Oreg., 1940; Columbia River at Cascades, Oreg., 1942; Upper Columbia and Snake rivers, Oreg. and Wash., 1949; Cowlitz River, Wash. 1952; Lower Clearwater River, Idaho, 1952.

EXAMINATIONS AND SURVEYS.—Columbia River above mouth of Snake River, Wash., 1963; Columbia and Snake rivers, 1970.

APPENDIX R R.

REPORT OF CAPT. CHARLES F. POWELL, CORPS OF ENGI

Improvements.—Mouth of the Columbia River, Oreg. and Wash., 1972;
Coos Bay, Oreg., 1989; entrance to Yaquina Bay, Oreg., 1998; mouth
River, Oreg., 2003; Umpqua River, Oreg., 2005; Skagit, Steilaquami
Snohomish, and Snoqualmie rivers, Wash., 2007; Chehalis River,
gauging waters of the Columbia River and principal tributaries, 2010

APPENDIX S S.

REPORT OF MAJ. G. J. LYDECKER, CORPS OF ENGINE

Improvements.—Washington Aqueduct, 2013; increasing the water
city of Washington, 2043; erection of fish-ways at the Great Falls of
River, 2061.

APPENDIX T T.

REPORT OF COL. JOHN M. WILSON, U. S. A.

Improvement and care of public buildings and grounds in the Distri
bia, 2075.

APPENDIX U U.

BRIDGING NAVIGABLE WATERS OF THE UNITED STA

Bridge across the Mississippi River at Keithsburg, in the State of Illinois
arch bridge across the West Channel of the Mississippi River at Minnes
2111; proposed bridge across the Ohio River at or near Cairo, Ill., 21
the Selma Bridge Company across the Alabama River at Selma, Ala., 2
in the original plan of the bridge across the Ohio River at Henderson

APPENDIX V V.

SUPPLEMENTAL REPORT OF THE MISSISSIPPI RIVER COMMI

Q. A. Gillmore, Col. of Engineers, Bvt. Maj. Gen., U. S. A., *President.*
C. B. Comstock, Lieut. Col. of Engineers, Bvt. Brig. Gen., U. S. A.,
Charles R. Suter, Major of Engineers, U. S. A.,
Mr. Henry Mitchell, Coast and Geodetic Survey,
Mr. B. M. Harrod, Civil Engineer,
Mr. S. W. Ferguson, Civil Engineer,
Mr. Robert S. Taylor,
Commissioners.

APPENDIX W W.

SUPPLEMENTARY REPORT OF THE MISSOURI RIVER COMMI

Charles R. Suter, Major of Engineers, U. S. A., *President.*
Alex. Mackenzie, Major of Engineers,
O. H. Ernst, Major of Engineers,
Mr. G. C. Broadhead,
Mr. William J. Broatch,
Commissioners.

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

(CONTINUED.)

APPENDIX F.

IMPROVEMENT OF DELAWARE AND SCHUYLKILL RIVERS, AND OF RIVERS IN NEW JERSEY—HARBOR IMPROVEMENTS IN DELAWARE RIVER AND BAY—CONSTRUCTION OF PIER AT LEWES—DELAWARE BREAKWATER.

REPORT OF LIEUTENANT-COLONEL HENRY M. ROBERT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Delaware River from Trenton, New Jersey, to its mouth.
2. Delaware River at Schooner Ledge.
3. Delaware River near Cherry Island Flats.
4. Frankford Creek, Pennsylvania.
5. Schuylkill River, Pennsylvania.
6. Ice-Harbor at Marcus Hook, Pennsylvania.
7. Ice-Harbor at the head of Delaware Bay, Delaware.
8. Construction of iron pier in Delaware Bay, near Lewes, Del.
9. Delaware Breakwater Harbor, Delaware.
10. Rancocas River, New Jersey.
11. Woodbury Creek, New Jersey.
12. Mantua Creek, New Jersey.
13. Raccoon River, New Jersey.
14. Salem River, New Jersey.
15. Cohansey Creek, New Jersey.
16. Removal of wrecks from Delaware Bay and River.
17. Removing sunken vessels or craft obstructing or endangering navigation.
18. United States commission advisory to the board of harbor commissioners of Philadelphia, Pennsylvania.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., July 29, 1886.

SIR: I have the honor to transmit herewith annual reports for the fiscal year ending June 30, 1886, of the river and harbor works under my charge.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

F 1.

IMPROVEMENT OF DELAWARE RIVER FROM TRENTON, NEW JERSEY, TO ITS MOUTH.

The river and harbor act of July 5, 1884, contained an appropriation of $200,000 for improving Delaware River from Trenton, N. J., to its mouth, "provided that not exceeding $10,000 of said sum shall be expended above Bridesburg."

A project was submitted January 23, 1885, by a Board of for "the permanent improvement of Delaware River and Ba was published in the Report of the Chief of Engineers for 1 822. The expenditure of the appropriation of July 5, 1884, h accordance with approved projects and the recommendatio Board.

During the past fiscal year the following operations hav progress:

(1) Survey of the Delaware River above Bridesburg.

(2) Examinations at points between the upper end of Petty and Delaware Bay, where there is now a less depth than 26 feet low water and a less width of channel than 600 feet, to deter character of the bottom and substratum of the river both in to be improved and over areas to be occupied by proposed dik observations at the same points, to determine the duration, d and velocity of the flood and ebb tides; and the running of levels between Trenton, N. J., and Cape Henlopen, Delaware.

(3) Construction of a gravel dike between Long Bar and Emil in the river above Bordentown.

(4) Construction of a brush and stone dike near Five-Mile tween Fisher's Point and upper end of Petty's Island.

(5) Construction of a brush and stone dike near Mifflin Bar, Hog and Maiden islands.

(6) Dredging a channel through Five-Mile Bar above Petty's

(7) Dredging in Main Ship-Channel west of Petty's Island.

(8) Dredging in Main Ship-Channel at Mifflin Bar.

The other matters relating to the improvement of the Delawa will be considered under the following heads:

(9) Smith's Island Bar.

(10) Injunction restraining contractors from building Fisher' Dike.

1. SURVEY OF THE DELAWARE RIVER ABOVE BRIDESBU

The survey of the Delaware River above Bridesburg consis detailed survey, which was carried to a point about 4 mile Trenton, or for a distance of about 24 miles above Bridesbur exhaustion of available funds prevented the completion of the

2. EXAMINATIONS, TIDAL OBSERVATIONS, AND LEVELS BELOW BURG.

The examinations and tidal observations at special points re improvement between Philadelphia and the Bay consisted in and probings, to determine the character of the bottom of tl both in the channels to be improved and over the sites of p dikes; and in tidal observations, to determine the duration, di and velocity of tidal currents. The determination of the char the river bed and substratum was made by borings carried to a from 30 to 40 feet below mean low water in the channels to be im and to varying depths over the areas to be occupied by the p dikes. Samples of the material passed through by the boring-r obtained, and are preserved for future reference.

Observations to determine the height and duration of the tid made by self-registering tide-gauges placed in the vicinity of r improvements. The direction of tidal currents was obtained mersed floats. Meters connected with recording chronographs were used to determine the velocity of the currents at the various stages of the tides.

The localities at which these examinations and tidal observations were made are the following: Fisher's Point or Five-Mile Bar, Mifflin Bar, Marcus Hook, Holly Oak, Salem Cove, Dan Baker Shoals, and Dutch Creek Flats. The funds available for this work were not sufficient to carry it to the degree of completion desired, and the work should be continued under future appropriations. The results already obtained will be a valuable aid in locating such works of improvement as it may be possible to undertake in the near future.

3. DIKE BETWEEN LONG BAR AND EMILY ISLANDS.

In the upper river, at a point about 2 miles below Trenton, a gravel dike was built across the inlet between Long Bar and Emily Islands, to replace the timber and stone dike built some years ago and subsequently destroyed by freshets. (Emily Island is now practically a part of the mainland.) The dike built during the past fiscal year was constructed of coarse material dredged from the vicinity of Periwig Shoal and transported to the site of the work on flat scows. The dike was about 300 feet long, 75 feet wide at base, and 30 feet wide at top, and was raised to a height of about 1 foot above ordinary high water. The work was done during the months of August and September, under an agreement with Frank C. Somers, at the rate of 59½ cents per cubic yard for material placed in the work. The cost of the dike was $2.062.09. During the spring freshets the height of the dike was somewhat reduced by the flow of water over its crest. The principal value of the work is that it affords a means of crossing for teams between the islands under cultivation and the adjacent mainland, and it was undertaken because in the construction of the previously built dike a channel had been dredged from the river into the inlet between the islands, which destroyed a then-existing road across the inlet.

4. DIKE BETWEEN FISHER'S POINT AND PETTY'S ISLAND.

Under a contract with John A. Bouker, dated August 7, 1885, a brush and stone dike was built, extending for a distance of 3,500 feet from the mainland at Fisher's Point towards the upper end of Petty's Island. The upper 3,000 linear feet of dike were brought to the height of mean low water, and the remaining 500 linear feet were extended as a sill, the top of which was about 10 feet below mean low water, to guard against possible scour at the lower end of the work. The dike consisted of a foundation or sill of brush mattresses 2½ feet thick and from 25 to 30 feet wide, surmounted with an embankment of random stone carried to the heights above named.

In this work 2,116 linear feet of piles, 7,031 cubic yards of mattress, and 14,878 cubic yards of stone were used. The brush mattress foundation or sill was placed upon an embankment about 100 feet wide and raised to a height of about 10 feet below mean low water, consisting of the dredged material removed from the main ship channel west of Petty's Island and placed in the embankment under the hereafter-described contract with the American Dredging Company. This material, consisting of gravel and bowlders, was of a character to resist scour, and consequently could be used with safety as a substructure for the dike. Its use permitted the construction of the dike with such reduced quantities of brush mattress and stone as to result in a saving of about $10,0 cost of the dike, without any increased cost to the dredging.

The work provided for under this contract was to have be pleted by December 15, 1885, but the progress of the work was suspended between September 4 and October 17, by the injun the State of New Jersey, issued against all parties engaged in struction of the dike. On account of this delay an extension of originally named for the completion of the contract was granted 30, 1886. (For an account of the injunction and other hindran No. 10.)

5. DIKE BETWEEN HOG AND MAIDEN ISLANDS (MIFFLIN B

Under date of July 30, 1885, a contract was entered into witl D. Register for the construction of about 5,500 linear feet of br stone dike between Hog and Maiden Islands, near Mifflin Bar. date for the completion of the contract, December 15, 1885, abo fourth of the contract had been completed. The contractor for th had been erroneously included among the parties enjoined from cuting the construction of Fisher's Point Dike, and although the tion issued did not apply to his contract, the work was delayed f apprehension that if the injunction upon the Fisher's Point Di maintained by the courts it would be followed by an injunction a the dike covered by his contract. At the close of the season' about 1,960 linear feet of dike had been built, covering about cent. of the work to be done under the contract. Although the pr of the work had not been satisfactory, an extension of time to Ju 1886, was granted, provided that at the beginning of the present s work was resumed with proper energy. After continued delay commence the work, the contract was finally annulled April 20, with a forfeiture to the United States of $2,944.87 of retained m

The work remaining to be done under the contract with Elij Register was readvertised, and on May 31, 1886, a contract w tered into with the lowest bidders, Robert Patterson & Son, for th struction of about 3,500 linear feet of dike. At the close of the year, 870 linear feet of dike had been partially built under this co

The loss to the United States by this failure consists in the inc amount of dredging on Mifflin Bar, due to the delay in buildi dike, which was designed to maintain the channel dredged acro bar last summer. The increased price for work under the new co as well as the increased cost of inspection, will be covered by t tained moneys forfeited to the United States.

Under date of April 26, 1886, a contract was made with Jo Bouker for the construction of about 1,800 linear feet of brush and dike in prolongation of the dike to be built under contract with D. Register, just referred to. At the close of the fiscal year the foundation of the work, 1,800 feet long and 25 feet wide, had been p covering 1,746 cubic yards of brush mattress, and 3,587 cubic ya stone deposited thereon.

The brush mattresses built this season differ from those used the contracts of last season, in that they are composed of loose in place of fascines, secured between binding frames, and with a of 1 foot of brush in place of 2 and 2½ feet, as before.

6. DREDGING AT FIVE-MILE BAR.

Under date of April 9, 1886, proposals were invited for about 1 cubic yards of dredging for the formation of a channel through

Mile Bar, just above the upper end of Petty's Island. The bids received, varying from $17\frac{8}{10}$ to 26 cents per cubic yard (the former bid being limited, however, to 50,000 cubic yards), were considered too high, and being slightly informal were therefore rejected and proposals by circular letter invited from the previous bidders for the removal of about 50,000 cubic yards. In response, the lowest bid was that of the American Dredging Company, at the rate of 9 cents per cubic yard, which was accepted. The dredging was commenced May 14, 1886, and early in June the 50,000 cubic yards of material were removed, and the results obtained seemed to justify a continuation of the dredging to the aggregate amount of 125,000 cubic yards.

By the authority of the Secretary of War the work was continued under an agreement with the American Dredging Company for the removal of the additional 75,000 cubic yards at the same rate as for the previous work. At the close of the fiscal year 91,194 cubic yards had been removed, and the entire amount will be removed before July 20.

The material, consisting of fine sand, was deposited by the scows immediately against the rear slope of the dike, thereby adding to its stability against the ice pressure of winter freshets.

The depth originally over the bar at mean low water was from 3 to 6 feet, and the distance across the bar, between the 12-foot curves, about 1,800 feet. The location of the dredged channel is near to the Philadelphia shore and in such a direction as to be coincident with the paths of both flood and ebb tides across the bar, as determined from recent tidal observations.

The object of the dredging in progress is the formation of a channel 12 feet deep at mean low water, connecting the deep water above with the deep water below the bar; this will afford great relief to the commerce moving between Philadelphia and the river above. This channel is not supposed to be permanent, but its value is so great as to be worth some cost in maintaining it.

7. DREDGING IN THE MAIN SHIP-CHANNEL WEST OF PETTY'S ISLAND.

Under a contract with the American Dredging Company dated July 29, 1885, for dredging in the main ship-channel west of Petty's Island, and under an agreement with the same company, dated November 18, 1885, for a continuation of the work at the same locality, 105,331 cubic yards of material were removed. The excavation was carried to a depth of 26 feet at mean low water, and resulted in increasing the previous channel to a width of about 400 feet.

The material excavated consisted of gravel and bowlders, the removal of which was estimated by the Board of Engineers in 1885 at 50 cents per cubic yard, the estimate being based upon previous prices at this locality. The work done under the above-named contract and agreement was at the rate of 19½ cents per cubic yard. The character of the material was such as to permit its deposition in the form of a wide embankment under the sill of the dike between Fisher's Point and Petty's Island, reducing the depth of water on the line of the dike to about 10 feet, and permitting the construction of the dike by such a reduced quantity of brush mattress and stone as to result in a saving of about $10,000 in the cost of the dike.

On September 4, 1885, the State of New Jersey served an injunction upon the American Dredging Company, enjoining them from the further placing of dredged material in the foundation of the dike then in process of construction by the United States between Fisher's Point and Petty's

Island. The injunction was dissolved by the United States court on October 17, 1885, and the construction of the foundatio dike by the use of dredged material resumed and continued to t of the agreement with the American Dredging Company. Dur interval between September 4 and October 17, 1885, the materia 27,000 cubic yards) dredged under the contract was deposited the dike in process of construction, near Mifflin Bar. Further al to this injunction are made in a subsequent part of this report.

The increased width to the main ship-channel, which resulte the dredging done under this contract, has made the piers at Poi mond available for the deep draught ocean steamers, and has been ɛ ble aid in the development of the large commercial interests bel to this part of the river front.

8. DREDGING AT MIFFLIN BAR.

Under a contract with the American Dredging Company, date 20, 1885, 98,145 cubic yards of material were removed from the c across Mifflin Bar, at the rate of 9½ cents per cubic yard. The di material was deposited by scows in the area behind the dike be Hog and Maiden islands, in process of construction, for the im ment of the channel at Mifflin Bar. The dredging was carrie depth of 26 feet at mean low water, and resulted in deepeni channel for a width of about 125 feet.

9. SMITH'S ISLAND BAR.

The cross-river traffic between Philadelphia and Camden is obstr by Windmill and Smith's islands and by Smith's Island Bar. islands and bar form a continuous obstruction nearly 1½ miles in le except at a narrow passage between Windmill and Smith's isl which was opened and is maintained by private enterprise.

There can be no question as to the necessity for an improved ch which will afford direct and convenient connection between the water in front of the two cities, and to the large inter-State comı affected thereby.

The appended report considers the plan for the formation of a nel 200 feet wide and 10 feet deep at mean low water at a point dir above the upper end of Smith's Island, and at the lower end of the The general direction of the bar is such as to place any channel thr the bar more or less across the line of tidal flow. To provide, as f possible, against the liability of such a channel refilling, its axis is posed to be placed quite oblique to the line of the bar, and its protected by a revetment. The estimated cost of the work is $4 of which $20,000 is for dredging and the remainder for the constru of the revetment.

If an appropriation is made for this work it should be specifie the improvement of channel between Philadelphia, Pa., and Can N. J., as it is no part of the present project for the improvement c main ship-channel of the Delaware River.

10. INJUNCTION AGAINST BUILDING FISHER'S POINT DIKE.

The construction of the dike at Fisher's Point, which was re mended by the Board of Engineers of 1884, for the improvement c river near Petty's Island, met with such opposition from the inte of Camden, N. J., as to necessitate an adjudication by the courts of the question of the right of the United States to continue its construction.

The Board of Engineers considered that the recommended improvement for this part of the river—

> Could be procured by building a deflecting dike, starting from Fisher's Point and running down-stream in a slightly curved direction, sensibly parallel with the pier-line of the Pennsylvania shore opposite, extending toward the head of Petty's Island so far as might be necessary for the purpose of diverting into the west channel a considerable part of the ebb tidal volume now passing down the east channel.
>
> When this dike shall have been extended sufficiently far to produce the necessary scour in the west channel, it should stop. It is probable, however, that in the construction of this dike an injurious scour may occur at and beyond its outer end as it progresses, and to prevent this it is recommended that a mattress sill of brush not more than 3 feet in thickness be kept well in advance of the outer end of the dike, and it may be necessary to extend this sill as far as the head of the island. Should any tendency to scouring be noticed at the head of the island, then that part should be protected by a revetment.
>
> The works designed for this locality will leave the channels on both sides of the island open, and will probably benefit that on the west side without doing injury to that on the east side.

The construction of this dike was commenced by the United States early in August, 1885, under contracts with the American Dredging Company for the depositing of dredged material in the foundation of the dike, and with John A. Bouker for the construction and placing of the brush mattresses and stone forming the body of the work.

On September 4, 1885, both contractors were enjoined by the State of New Jersey from further work upon the dike. A copy of the information upon which the injunction was granted is appended as Schedule A and the injunction as Schedule B. In accordance with the requirements of the injunction, operations upon the dike at once ceased.

By instructions from the Department of Justice, United States District Attorney Hon. John K. Valentine, at Philadelphia, was directed to take such steps as might be necessary to protect the interests of the United States in connection with the injunction against the Government contractors restraining them from building the dike in question.

The proceedings were commenced in the court of chancery for the State of New Jersey, but were removed into the circuit court of the United States for the district of New Jersey. In the September term of court the American Dredging Company and John A. Bouker, defendants, submitted their answer to the bill of complaint of the attorney-general of the State of New Jersey, informant, as shown in Schedule C.

On October 17 the case was heard under the argument of United States District Attorney John K. Valentine, as set forth in Schedule D, and on the same date the injunction was dissolved by the court.

Under date of September 30 Hon. W. J. Sewell, United States Senator, submitted to the honorable the Secretary of War a statement of the injuries to public and private rights which would result from the construction of the proposed work, with a request that before operations were resumed upon the dike the Board of Engineers be reconvened to take into consideration the objections urged. This communication was referred to the officer in charge for report, and will be found with the report appended as Schedule E.

By Special Orders No. 167, Headquarters Corps of Engineers, United States Army, Washington, D. C., October 22, 1885, the Board of Engineers of 1884 was reconvened at Philadelphia for the purpose of considering certain objections made by citizens of Camden to the construction of the dike in question. The Board met on October 26, 1885, and under date of October 28, submitted to the Chief of Engineers thei This report, together with the recommendations of the Chief (neers, and the approval of the same by the honorable the Secr War, is appended as Schedule F.

During the present season available funds will be applied to t in progress towards the formation of a dredged channel 12 feet mean low water through Five-Mile Bar, above Petty's Island, an work of dike construction near Mifflin Bar.

In the reports on special localities on the Delaware River wh arate appropriations have been made in the past, it has been mended that, in the best interests of the work and of comm(funds for the improvement of the channel of the Delaware Rive be hereafter appropriated under the general title of "improve Delaware River from Trenton, N. J., to its mouth." The impro recommended by the Board of 1884 is the formation of a chann a point in the river near the upper part of Philadelphia to dee in Delaware Bay, with a least width of 600 feet, and having a of 26 feet at mean low water. This is to be accomplished, ex Schooner Ledge, where solid rock is to be removed, by means o lating and constructing works, aided, where necessary, by dr The estimated cost of the work recommended is about $2,425,00

An appropriation of $600,000 is recommended for the fiscal ye ing June 30, 1888, to be applied to dredging and dike constructi gether with any necessary surveys and observations, all in acco with the project for the permanent improvement of Delaware Riv Bay.

The Delaware River is tributary to the following collection dis Trenton, Philadelphia, Delaware, and Bridgeton. The amount c enue collected in these districts during the year ending Decem 1885, was $13,812,764.54. Total amount appropriated for improv of Delaware River from 1836 to June 30, 1886, $1,552,000.

Total expeditures to June 30, 1886	$1,499,
Total amount appropriated on present project to June 30, 1886	200,
Total expenditures on present project to June 30, 1886	147,

Money statement.

July 1, 1885, amount available		$185,
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$133,273 88	
July 1, 1886, outstanding liabilities	34,374 09	
		167,
July 1, 1886, amount available		17,
Amount appropriated by act approved August 5, 1886		210,
Amount available for fiscal year ending June 30, 1887		227,
Amount (estimated) required for completion of existing project		*2,215,
Amount that can be profitably expended in fiscal year ending June 30, 1888		600,
Submitted to compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.		

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*The estimated cost of the permanent improvement of the Delaware River b the upper part of Philadelphia and deep water in the bay was $2,425,123. Th cost of the permanent improvement of the river between Trenton, N, J., mouth cannot be stated until after the completion of the survey now in prog tween Bridesburg and Trenton, and the formation of a project based thereon.

Abstract of proposals for dredging in Delaware River, west of Petty's Island, received and opened July 20, 1885, by Lieut. Col. Henry M. Robert, Corps of Engineers.

No.	Names and addresses of bidders.	Price per cubic yard.	Remarks.
1	Frank C. Somers, Philadelphia, Pa	$0 27	
2	New York Steam Dredging Company, New York City	0 75	Bowlders of 1 ton or over, at $6 per ton.
3	American Dredging Company, Philadelphia, Pa	0 19½	Recommended for acceptance.

Contract (dated July 29, 1885) awarded to American Dredging Company.

Abstracts of proposals for dredging in Delaware River at Mifflin Bar, received and opened July 20, 1885, by Lieut. Col. Henry M. Robert, Corps of Engineers.

No.	Names and addresses of bidders.	Price per cubic yard.	Remarks.
1	New York Steam Dredging Company, New York City	$0 26	
2	National Dredging Company, Wilmington, Del	0 14	
3	American Dredging Company, Philadelphia, Pa	0 09½	Recommended for acceptance.

Contract (dated July 29, 1885) awarded to American Dredging Company.

Abstract of proposals for constructing a dike in Delaware River between Hog and Maiden islands, received and opened July 23, 1885, by Lieut. Col. Henry M. Robert, Corps of Engineers.

No.	Names and addresses of bidders.	Approximate quantities.				Total.
		Piles, 4,000 linear feet.	Brush mattress, 10,500 cubic yards.	Annealed iron wire, 33,000 pounds.	Stone, 13,000 cubic yards.	
		Per lin. ft.	*Per cu. yd.*	*Per lb.*	*Per cu. yd.*	
1	John Satterlee, Englewood, N. J	$0 30	$1 50	$0 05	$2 40	$49,800 00
2	Frank Pidgeon, New York City	30	5 98	03	1 97	90,590 00
3	Joseph S. Allen and John P. Eyre, Philadelphia, Pa	14	2 31	09½	1 94	53,170 00
*4	Elijah D. Register, Lewes, Del	13	1 69	02½	1 17	34,300 00
5	John F. Dawson, New York City	09½	1 65	03¾	1 79	42,212 50
6	Michael Herron, Bordentown, N. J Michael O'Rourke, Philadelphia, Pa	17	4 50	03¾	2 37	79,977 50
7	Neveling & Co., Philadelphia, Pa	15	2 00	03	1 60	43,390 00
8	John A. Bouker, New York City	20	1 87	05	1 75	44,835 00
9	American Dredging Co., Philadelphia, Pa.	14	2 73	03	1 95	55,565 00
10	Samuel R. Cumming, New York City	25	1 92	08	1 65	45,250 00

*Recommended for acceptance.

Contract (dated July 30, 1885) awarded to Elijah D. Register. Contract annulled April 20, 1886.

INFORMALITIES IN PROPOSALS.

No. 1. Notarial seal omitted from justification of one guarantor.
2. Certificate signed by notary public instead of United States official.
3. Only one guarantor; no certificate.
5. Certificate signed by notary public instead of United States official, and of the three signatures of the notary only one has the title.
6. Signatures of guarantors without seals, and price in figures omitted.
7. Signatures of guarantors without seals, the two bids differ in price of stone, and one guarantor's signature omitted from one bid.
8. In one copy of bid price of brush as given in figures differs from the price in words.
10. Certificate signed by both a notary public and the chief clerk navy pay office instead of by United States official.

Abstract of proposals for constructing a dike in Delaware River between Fisher's P Petty's Island, received and opened July 23, 1885, by Lieut. Col. Henry M. Robe of Engineers.

No.	Names and addresses of bidders.	Approximate quantities.			
		Piles, 2,000 linear feet.	Brush mattress, 8,800 cubic yards.	Annealed iron wire, 22,000 pounds.	Stone, 14,000 cubic yards.
		Per lin. ft.	*Per cu. yd.*	*Per lb.*	*Per cu. yd.*
1	Frank Pidgeon, New York City	$0 30	$5 98	$0 03	$1 97
2	J. P. Eyre & Co., Philadelphia, Pa	14	2 31	09½	1 85
3	Michael Herron, Bordentown, N. J Michael O'Rourke, Philadelphia, Pa	17	4 50	03¾	2 37
4	Neveling & Co., Philadelphia, Pa	03	2 00	03	1 60
5	John A. Bouker, New York City	20	1 83	05	1 70
6	American Dredging Co., Philadelphia, Pa	14	2 73	03	1 95
7	Samuel R. Cumming, New York City	25	1 92	08	1 65
8	John Satterlee, Englewood, N. J	20	1 50	05	2 40
9	John F. Dawson, New York City	09½	1 65	03¾	1 79

Contract (dated August 7, 1885) awarded to John A. Bouker.

INFORMALTIES IN PROPOSALS.

No. 1. Certificate signed by a notary public instead of United States official.
3. No seals attached to signatures of guarantors, and prices in figures omitted.
4. No seals attached to signatures of guarantors, and the two copies of bid differ in prices o and stone, the copy giving the lowest prices being entered in abstract.
7. Certificate signed by notary public and by chief clerk navy pay office instead of United official.
8. Signature of one guarantor unwitnessed, and notarial seal omitted with signature of no one justification.
9. Certificate signed by notary public instead of United States official, and title omitte two of his three signatures.

Abstract of proposals for furnishing and delivering 20 tons coal at United States neer Office, No. 1125 Girard street, Philadelphia, Pa., received in response to ci letter, and opened October 28, 1885, by Lieut. Col. Henry M. Robert, Corps of Eng

No.	Names and addresses of bidders.	Fourteen tons broken coal.	Six tons stove coal.	A
		Per ton.	*Per ton.*	
1	O'Brien & Co., Philadelphia, Pa	$5 50	$5 75	
2	Frank K. Ward, Philadelphia, Pa	5 20	5 24	
3	Branson & Bro., Philadelphia, Pa	4 80	4 98	
4	Wm. Jordan, Philadelphia, Pa	5 15	5 35	

* Accepted.

Abstract of proposals for constructing a dike in Delaware River between Hog and Maiden islands, received and opened April 22, 1886, by Lieut. Col. Henry M. Robert, Corps of Engineers.

No.	Names and addresses of bidders.	Approximate quantities.				Total.
		Piles, 1,000 linear feet.	Brush mattress, 1,800 cubic yards.	Annealed iron wire, 3,000 pounds.	Stone, 12,000 cubic yards.	
		Per lin. ft.	*Per cu. yd.*	*Per lb.*	*Per cu. yd.*	
1	William M. Field, Kentmere, Del.	$0 17	$1 75	$0 03	$1 50	$21,410
2	United States Dredging and Canal Construction Company, New York City	20	1 68	07	1 75	24,434
*3	B. G. Bailey, New York City	35	4 00	15	2 70	40,400
4	Ira Lunt, New Castle, Del.	20	1 75	05	1 50	21,500
*5	H. S. Wright, Philadelphia, Pa	20	1 85	05	1 74	24,560
6	Robert Patterson & Son, Philadelphia, Pa	14	1 68	03	1 58	22,214
7	John Satterlee, Englewood, N. J	19	1 05	03	1 61	21,490
†8	John A. Bouker, New York City	20	1 70	05	1 45	20,810
9	Waldo Danforth, Bergen Point, N. J.	15	2 10	05	1 84	26,160

* Informal. † Recommended for acceptance.

Contract (dated April 26, 1886) awarded to John A. Bouker. In progress.

Abstract of proposals for dredging in the Delaware River, at Five-Mile Bar above Petty's Island, received and opened April 29, 1886, by Lieut. Col. Henry M. Robert, Corps of Engineers.

No.	Names and addresses of bidders.	Price per cubic yard for—		
		First 50,000 cubic yards.	Quantity in excess of 50,000 cubic yards.	Total quantity that may be required.
		Cents.	*Cents.*	*Cents.*
1	Edgar M. Payn, Albany, N. Y	17.9		
2	Frank C. Somers, Philadelphia, Pa			23½
3	The Delaware and Chesapeake Improvement Company, Philadelphia, Pa			26
4	American Dredging Company, Philadelphia, Pa	20	19	

INFORMALITIES IN PROPOSALS.

No. 1. Bid limited to 50,000 cubic yards: failed to comply with paragraph 16 of instructions to bidders, bid being sent by mail in a single envelope with nothing to indicate its contents.
No. 2. No seals attached to signatures of guarantors.
No. 3. Certificate of justification signed by a notary public instead of United States official.
No. 4. Notarial seal omitted to justifictaion of one guarantor.

All bids rejected.

Abstract of proposals for furnishing and delivering stationery at the United States Engineer Office, No. 1125 Girard street, Philadelphia, Pa., received in response to circular-letter and opened May 18, 1886, by Lieut. Col. Henry M. Robert, Corps of Engineers.

No.	Names and addresses of bidders.	Amount.
1	Joe H. Mann, Philadelphia, Pa	$117 16
*2	Altemus & Co., Philadelphia, Pa	119 08
†3	C. A. Smith, Philadelphia, Pa	115 40

*This bid omits the last two items bid for by the other two parties at $8 and $3.12, respectively.
†Accepted.

Abstract of proposals for constructing a dike in Delaware River between Hog an islands, received and opened May 20, 1886, by Lieut. Col. Henry M. Robert, Engineers.

No.	Names and addresses of bidders.	Approximate quantities.			
		Piles, 2,500 linear feet.	Brush mattress, 3,600 cubic yards.	Annealed iron wire, 5,500 pounds.	Stone, 10,000 cubic yards.
		Per lin. ft.	*Per cu. yd.*	*Per lb.*	*Per cu. yd.*
1	John Satterlee, Englewood, N. J	$0 19	$1 69	$0 04	$1 49
*2	Robert Patterson & Son, Philadelphia, Pa	14	1 53	03	1 38½
3	William M. Field, Wilmington, Del.	16	1 65	02½	1 39
4	Ira Lunt, New Castle, Del	18	1 67½	05	1 44
5	John A. Bouker, New York, N. Y.	20	1 53	05	1 45

* Recommended for acceptance.

Contract (dated May 31, 1886) awarded to Robert Patterson & Son. In pr

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Abstract of proposals for furnishing and delivering coal, as may be required, during the of 1886, for use of the United States steam-yacht Mermaid and launch Portia, r in response to circular-letter and opened June 22, 1886, by Lieut. Col. Henry M. Corps of Engineers.

No.	Names and addresses of bidders.	Price per ton.	Rem
1	George B. Newton & Co., Philadelphia, Pa	$4 25	
2	William F. Moody & Son, Philadelphia, Pa	3 95	Acce

Abstract of formal written contracts for improvements in the Delaware River enter during the fiscal year ending June 30, 1886.

Date of contract.	Names and addresses of contractors.	Subject of contract.	Prices.			
			Dredging per cubic yard.	Dike constructi		
				Piles, per linear foot.	Brush mattress, per cubic yard.	Annealed iron wire, per pound.
			Cents.	*Cents.*	*Dollars.*	*Cents.*
[1] July 29, 1885	American Dredging Co., Philadelphia, Pa.	Dredging west of Petty's Island.	19½	......	....	......
[2] July 29, 1885	American Dredging Co., Philadelphia, Pa.	Dredging at Mifflin Bar.	9½	......	....	.....
[3] July 30, 1885	Elijah D. Register, Lewes, Del.	Dike between Hog and Maiden islands.	....	13	1 69	2½
[4] Aug. 7, 1885	John A. Bouker, New York City.	Dike between Fisher's Point and Petty's Island.	....	20	1 83	5
April 26, 1886	John A. Bouker, New York City.	Dike between Hog and Maiden islands[5]	....	20	1 70	5
May 31, 1886	Robert Patterson & Son, Philadelphia, Pa	Dike between Hog and Maiden islands[5]	....	14	1 53	3

[1] Completed November 17, 1885.
[2] Completed October 14, 1885.
[3] Annulled April 20, 1886.
[4] Completed June 30, 188
[5] In progress.

PAPERS RELATING TO THE ACTION OF THE STATE OF NEW JERSEY AGAINST THE CONTRACTORS FOR BUILDING THE FISHER'S POINT DIKE, REFERRED TO IN THE PREVIOUS PART OF THIS REPORT.

SCHEDULE A.—THE INFORMATION.

In Chancery of New Jersey.

To his honor THEODORE RUNYON,
Chancellor of the State of New Jersey:

Humbly informing your informant, John P. Stockton, attorney-general of the State of New Jersey, who informs for and on behalf of said State, informs and shows unto your honor as follows:

I. That the ground and soil of the coast and shores of the sea around the territory of the State of New Jersey, and of every port, haven, and arm of the sea, creek, pool, and navigable river which are wholly within the boundaries of said State, and into which the sea ebbs and flows, and also the ground and soil of all that part of the Delaware and Hudson rivers, and of New York Bay or harbor, and of the Kill von Kull, Staten Island Sound, and Delaware Bay and Raritan Bay, which lie within the boundary line between the State of New Jersey and the State of New York, as defined and established by an act of the legislature for that purpose, passed February 26, 1834, and within the boundary line between the State of New Jersey and the State of Pennsylvania, to wit: The middle line of the Delaware River and Delaware Bay, and also the shores thereof lying between high-water mark and low-water mark at ordinary tides are the property in fee simple of the State of New Jersey, by virtue of its prerogative right as a sovereign State; that in particular the said State of New Jersey is seized in fee of the ground and soil of all that part of the Delaware River surrounding the island known as Petty's Island, lying in the Delaware River opposite the city of Camden, from high-water mark at ordinary tides out to the middle line of the Delaware River, towards Pennsylvania, and from said middle line eastward to the fast land on the New Jersey shore; and that all of said Petty's Island is within the dominion of the State of New Jersey, and within the corporate limits of the township of Stockton, in the county of Camden; and that said State of New Jersey has a right of empire and government over the waters covering the said ground and soil, which waters are, and ever have been, navigable waters, and has full right and power to see to the navigation of said waters, and to prevent the erection of obstructions and nuisances in the said waters.

II. That by an act of legislature of the State of New Jersey, entitled "An act to ascertain the rights of the State and of the riparian owners in the lands lying under the waters of the bay of New York and elsewhere in the State," approved April 11, 1864, and the various supplements thereto, the said State of New Jersey has made provision for the use of the said ground and soil, and the waters covering the same, and has regulated the erection of piers, wharfs, bulk-heads, and other erections and permanent obstructions thereon and therein, so as to promote and conserve the public rights of navigation in said waters; and by its board of riparian commissioners, acting in pursuance of the provisions of the aforesaid acts and supplements, has established in the waters aforesaid a bulk-head line, for the permanent and solid filling up of said waters, and beyond which no such permanent and solid filling can lawfully be made; and, also, an exterior pier line, beyond which no pier or wharf can be lawfully made, and have vested in said board of riparian commissioners, together with the governor and attorney-general, the exclusive power to grant, lease, license, and regulate the use of said ground, soil and waters, and the erection of bulkheads, solid filling piers, wharfs, and other permanent erections and obstructions therein and thereon.

III. That between said "Petty's Island" [which is about two miles long] and the mainland is a large body of the river Delaware and a large and deep channel, navigable for large vessels, and having a depth at low tide, of over 20 feet; and that said channel is much used by vessels navigating the Delaware River, and by the inhabitants of this State, for the purpose of commerce and in the pursuit of their usual business and avocations; and that large shipyards and vessel-building establishments are located in Camden City, on said division of the Delaware River, and use and are interested largely in said channel; that the same is maintained and kept free from obstructions of any kind to navigation; and, further, that a large portion of the river Delaware now ebbs and flows between the New Jersey mainland and said "Petty's Island," and keeps the same free and clear, as it ever hath done.

IV. That Cooper's Creek, one of the boundary lines of the city of Camden, and a large stream of water, navigable and much used for navigation, lying wholly within the State of New Jersey, is tributary to the Delaware River, and empties therein in the aforesaid stream and channel.

V. That located on the bank of the Delaware River, at Pavonia, in the t
of Stockton, in the county of Camden, are the water-works which furnish tl
water supply for the said city of Camden, and that said supply is drawn f
said Delaware River by pipes extending from a pier at said works directly i
river, and is pumped therefrom and stored in a reservoir erected for that j
directly east therefrom, on a high elevation of ground, and that said supp
through which said water is pumped, opens into the river above the mouth c
er's Creek a considerable distance, and about one and a fifth miles below th
end of said "Petty's Island," and in the aforesaid stream and channel, and
reason of the free ebbing and flowing of such a large body of water betw
"Petty's Island" and the mainland, as before mentioned, and as has heretof
the case, the water supply of the city of Camden has been very pure and wh
and of a very excellent character.

VI. That said water works are the property of the city of Camden, and, i
dition to entirely supplying the said city, supply also some of the adjacent tov
dering on the city limits with water.

VII. That "the American Dredging Company," a corporation of the State o
sylvania, engaged in the business of making excavations and dredging in
creeks, and harbors, has, since on or about the first day of August, been dredgi
digging soil, mud, and dirt from the channel of the river Delaware, which e
along or near the western or Pennsylvania shore thereof, and dumping and dep
the same in said river at the upper or north end of said "Petty's Island," s
continue the same out further into the aforesaid stream or channel flowing b
said island and the New Jersey mainland, with the avowed purpose of making
wall of mud, dirt, and soil, in the nature of a dike, from said island to the New
mainland; and that said company has been continuously at work since that
and has deposited and dumped there soil and earth to the extent of from 800 t
cubic yards per day each and every day since about the first day of last August
said; and that one John A. Bouker has already commenced, or is about to com
to drive piles, and continue and complete said work of building said solid dik
said island to the New Jersey mainland, and that said earth and soil is now
dumped and deposited, and said piles are being, and are threatened to be, drive
and in the ground and soil outside of the exterior bulkhead line and the exteri
line, so as aforesaid established by law, and in and upon the ground and soil
is the property in fee of the State of New Jersey; and give out and pretend th
have the right and authority in law, and declare and assert that they intend, s
proceeding, to drive permanent piles and fill in sufficient soil and earth to bui
construct so as to have entirely finished and completed, on or before the first
November next, a solid, permanent, and substantial dike or wall of earth, to
from the aforesaid upper end of "Petty's Island" to the New Jersey mainla
order to turn the large body of water heretofore ebbing and flowing to the e
said "Petty's Island" in and through the aforesaid channel between said islar
the New Jersey mainland, into the western or Pennsylvania channel aforesaid
river, and that other persons, to your informant unknown, are assisting and c
uting to the erection of said dike or wall, in order that when said dike is fi
and completed, the said western or Pennsylvania channel will be deepene
widened, and the said eastern or New Jersey channel will be entirely closed.

VIII. That if the said above-mentioned plan and project is carried out an
dike or wall is built and erected, as is proposed to be done as aforesaid, that t
of said eastern or New Jersey Channel will be entirely destroyed, that the bi
and commerce of the inhabitants of this State, so as aforesaid carried on there
thereon, will be destroyed, and that said ship-yards and vessel-building est
ments now carried on in said city of Camden will be greatly injured and dama
not entirely extinguished and wiped out, and that the aforesaid Cooper's Cr
the prevention of the free flowing of the present large body of water before the
thereof, will become filled up and rendered unfit for navigation; and in addi
the above-named damages and dangers, the building and finishing of said d
aforesaid, will cause a cove to form around and about the present supply-pipe
aforesaid water-works of the city of Camden, wherein will be carried mud, refu
filth, at all times floating in and about the rivers having large cities upon their
which said mud, refuse, and filth carried and deposited in said cove by the flo
will not be carried out by the ebb tide in said river, because there will be no fr
rent of water flowing from above to force the same; so that the whole water
of the said city of Camden will in a very short time become unwholesome, i
and poisonous, and will create disease and cause damage and death among the
itants of this State in the city of Camden and elsewhere using said water, a
deposit of such mud, refuse, and filth would of itself create a nuisance prejudi
the health of the inhabitants of this State.

IX. That there is no other or convenient place where works to supply the sa
of Camden with water can be erected or maintained.

X. That the aforesaid actions and deeds of the said the American Dredging Company and John A. Bouker, and their associates, are contrary to law and without any warrant or authority whatsoever, and that said dike is being built without warrant or authority of law, and that the same is a public nuisance and obstruction to navigation, so far as the same has already progressed, and if permitted to continue to completion will be a much more serious obstruction to navigation, and that the same is a wanton invasion of the public property of the State, and will destroy the business and commerce of the citizens of this State, and will prove destructive of the purity of the water supply of the city of Camden, and render the same noxious and unwholesome, and cause damage, sickness, and disease in said city, destroying the public health and prove a public nuisance to the citizens of this State.

Your informant therefore prays that the said the American Dredging Company and John A. Bouker may answer and set forth the premises fully and particularly what has already been done by them, and each and every of them, and what is yet proposed to be done, and under what authority or pretended authority, and that the earth and soil already deposited as aforesaid, and piling driven, and other work done in the construction of the said dike as aforesaid, may be removed and the nuisance thereof be abated, and that the said defendants may be perpetually enjoined from further depositing any earth, soil, mud, dirt, stones, or other material, or driving any piles or doing any work, matter, or thing towards the construction of the aforesaid dike, or extending said island over from the north end thereof to the New Jersey mainland, or in anywise interfering with or obstructing said channel on the eastern or New Jersey side of said river Delaware, between said "Petty's Island" and New Jersey mainland, or in anywise interfering with, polluting, damaging, or destroying the source of the water supply of the said city of Camden, and that your informant may have such other and further relief as the nature and circumstances of the case may require, and as may seem agreeable to equity and good conscience.

May it please your honor, the premises considered to grant unto your informant not only the State's writ or writs of injunction issuing out of and under the seal of this honorable court, pursuant to the prayer aforesaid, but also the State's writ of subpœna, issuing out of and under the seal of this honorable court, directed to the said The American Dredging Company and John A. Bouker, therein and thereby commanding them and every of them, on a certain day and under a certain penalty therein to be expressed, to be and appear before this honorable court, then and there to answer fully the premises, but without oath or affirmation, which is hereby waived, and to stand, to abide, and perform such order and decree therein as to your honor shall seem meet and agreeable to equity and good conscience.

And your informant will ever pray, &c.

JOHN P. STOCKTON,
Attorney-General.

STATE OF NEW JERSEY, *Camden County, ss:*

John D. Leckner, of full age, being duly sworn according to law, on his oath saith, that he resides in the city of Camden, and the County of Camden, and State of New Jersey, and that he is a practicing physician in said city, that he is a member of the city council of the city of Camden from the fifth ward of said city, and is also chairman or presiding officer of the board of health of the said city of Camden, and that Petty's Island lies in the Delaware River north and west of the city of Camden partly, and partly of the township of Stockton, and is about two miles long, and is quite narrow; that the Delaware River divides at the head of said island, and one channel flows along the eastern or New Jersey mainland or bank and one on the western or Pennsylvania bank of said river; that said island is wholly within the limits of the township of Stockton, in the county of Camden, and State of New Jersey; that a large body of water flows between said island and the New Jersey mainland with the ebb and flood of the tide, and that said channel along said New Jersey is a large and deep channel, having a depth of 20 feet at low water, and navigable for large vessels, and is much used by the citizens of the State of New Jersey for the purpose of the carrying on of their business, and for commerce and navigation, and that large ship-yards and vessel-building establishments are located in the said city of Camden on said stream or channel, and make use of and employ the same in carrying on their said business; that Cooper's Creek, a large navigable stream of water, empties into said stream or channel; that said creek is much used for navigation: that the water works which furnish the entire water supply for the city of Camden and some neighboring towns are located at Pavonia, in the said township of Stockton, on the mainland, opposite a point on said island about one and one-fifth miles below the upper or north end of said island, and that said water supply is drawn from said Eastern or New Jersey Channel, and that by reason of the ebb and flow of a large body of water through said channel and the depth thereof the water drawn therefrom has been very pure and wholesome, making the water supply of the city of

Camden exceptionally good for a large city; that there is no other availa
where the water-works for the city of Camden could be located; that "The A
Dredging Company" is now engaged in digging mud, earth, and soil from the
or Pennsylvania Channel of said river, and dumping and depositing the s
said river from the end of said island at the north, in order to build a solid
dike from the north end of said island to the New Jersey mainland, so as to clos
Eastern or New Jersey Channel, prevent the ebb and flow of said large body
between said island and New Jersey mainland, and divert the same to the We
Pennsylvania Channel in order to broaden and deepen the same; that said c
has been engaged in said work since on, or about the 1st day of August last p
are depositing said mud, soil, and earth at the rate of 800 to 1,000 cubic yards
and have already done great damage to navigation and the water supply of
of Camden; and that one E. L. Register has commenced or is about to comm
drive pilings so as to complete and strengthen said dike or wall, and it is the
of said company and said Register to build a solid, permanent, and substanti
from the upper or north end of said island to the New Jersey mainland, so as
and destroy the aforesaid New Jersey Channel, prevent the ebb and flow of th
said large body of water, and ruin and destroy said ship-yards and vessel-build
tablishments, cause said Cooper's Creek to fill up and destroy its navigatio
create a cove or pool in which the flood of the tide will carry the mud, refu
filth always abounding in rivers on which are situate large cities and depos
same in said cove and it will there remain, there being no force of water at
carry the same off at the ebb of the tide, so that in a very short time a large st
pool will be created, abounding in refuse and filth, from which the water sup
the city of Camden aforesaid must be drawn, and so cause said water to becom
ious and unwholesome, and cause sickness, damage, and death to the citizens
city of Camden and of this State, and destroy the health of the community; th
building of said dike is on the property of the State of New Jersey, is witho
warrant or authority of law, and is an obstruction to navigation, and a publ
sance to the citizens of this State, and a destruction of their property and righ
of the public health; that the above-mentioned acts and purposes of said defen
said company, and said Register have just come to the knowledge of this dep
and deponent further saith that he has read the foregoing information, and t
the matters therein contained are true to the best of his knowledge and belief.

J. D. LECK

Sworn and subscribed before me at Camden this 3d day of September, A. D.

N. G. STYRON, *M.*

STATE OF NEW JERSEY, *Camden County, ss:*

D. Cooper Carman, of full age, being duly sworn according to law, on hi
saith, that he is the city clerk of the city of Camden and the clerk of the bo
health of said city; that he has read the foregoing information, and that the m
and things therein stated are true to the best of his knowledge and belief, ar
ticularly are the matters and things stated and contained in the foregoing af
made by Dr. John D. Leckner, which deponent has carefully read, true.

D. COOPER CAR

Sworn and subscribed before me at Camden this 3d day of September, A. D.

N. G. STYRON, *M.*

SCHEDULE B.—THE INJUNCTION.

New Jersey, to wit: The State of New Jersey to "The American Dredging
[SEAL.] pany" and E. L. Register, their workmen, servants, and agents, an
and every of them, greeting:

Whereas it hath been represented to us, in our court of chancery, on the
the State of New Jersey of the attorney-general, John P. Stockton, that h
lately exhibited his information against you, the said "The American Dredgin
pany" and E. L. Register, defendants, to be relieved touching the matters set f
said information:

We, therefore, in consideration of the premises, and of the particular matt
forth in said information, do strictly enjoin and command you, the said "The
can Dredging Company" and E. L. Register, your and each of your workmen
ants, and agents, and all and every the persons before mentioned, and each and
of you, under the penalty that may fall thereon, that you and every of you d
lutely desist and refrain from further depositing any earth, soil, mud, dirt, sto
other material, or driving any piles, or doing any work, matter, or thing towa
construction of any dike or wall from the north end of Petty's Island over

New Jersey mainland, or extending said island over from the north end thereby to the New Jersey mainland, or in anywise interfering with or obstructing the Eastern or New Jersey Channel of the Delaware River flowing between said island and the New Jersey mainland, or in anywise interfering with, polluting, damaging, or destroying the source of the water supply of the said the city of Camden, until you, the said defendents, shall have fully answered the said information and our said court shall make other order to the contrary.

Witness his honor Theodore Runyon, our chancellor, at Trenton, the fourth day of September, in the year of our Lord one thousand eight hundred and eighty-five.

GEO. S. DURYEA,
Clerk.

JOHN P. STOCKTON,
Attorney-General.

SCHEDULE C.—THE ANSWER OF THE DEFENDANTS.

In the circuit court of the United States for the district of New Jersey, in the third circuit, September term, 1885. No. 5.

Answer of the American Dredging Company and John A. Bouker, defendants, to the bill of complaint of the attorney-general of the State of New Jersey, informant.

These defendants, now, and at all times hereafter saving and reserving unto themselves all benefit and advantage of exception which can or may be had or taken to the many errors, uncertainties, and other imperfections in the said informant's bill of complaint contained, for answer thereunto, and to so much and such parts thereof as these defendants are advised is or are material or necessary for them to make answer unto, answering, say:

I. That under the provisions of the act of Congress passed the 5th day of July, 1884, the sum of $200,000 was appropriated for the purpose of improving the Delaware River, from Trenton, New Jersey, to its mouth—continuing improvement. That the Delaware River is a part of the navigable waters of the United States connecting with the Atlantic Ocean, and lying between the States of Pennsylvania, New Jersey, and Delaware, and forms a continuous channel for commerce with foreign countries and among the States.

That a plan for the permanent improvement of the said river was recommended by a Board of Engineers of the United States Army, which said plan was approved and adopted by the Secretary of War of the United States, on the 2d day of May, 1885; that a part of said plan for the improvement of said river is the deepening of the channel thereof in front of the city of Philadelphia by the construction of a dike from Fisher's Point southward toward Petty's Island, for about 3,500 feet in length; that under the authority of the said act of Congress the said The American Dredging Company entered into a contract with the United States of America, on the 29th day of July, 1885, and the said John A. Bouker, on the 7th day of August, 1885, to build and construct said dike, and that in pursuance of said contract, and under the superintendence of Henry M. Robert, lieutenant-colonel of Engineers, of the Army of the United States, and under the authority and direction of the Secretary of War, the said defendants were proceeding to construct said dike aforesaid, which is the matter complained of in said bill; that other than as said contractors aforesaid, acting under the supervision and direction of the Secretary of War of the United States, as before stated, the defendants in the above case have done no act whatever touching the matter complained of in said bill.

II. These defendants aver that under the provisions of the act of Congress aforesaid, and under the authority and direction of the Secretary of War as aforesaid, they have been duly authorized, and have the right to proceed to perform the work and to construct the aforesaid dike in the said Delaware River; without this, that any other matter or thing whatsoever in said bill of complaint contained, material or effectual in the law to be answered unto, and not herein and hereby well and sufficiently answered unto, confessed and avoided, traversed or denied, is true, all of which matters and things these defendants are and will be ready to aver, maintain, and prove, as this honorable court shall direct, and pray to be hence dismissed with their costs and charges in this behalf, most wrongfully sustained.

AMERICAN DREDGING COMPANY.
ISAAC ALBERTSON,
President.

Attest:
FLOYD H. WHITE,
[SEAL.] *Secretary.*
Witness:
CHAS. DAY.

JOHN A. BOUKER.

[illegible]

[illegible] to law, says that he is the
[illegible] the above-named defendants, a
[illegible] so far as they are within his knowl
[illegible] information and belief are tru
[illegible] belief.

ISAAC ALBE

[illegible] seventh day of October, A. D., 1885.

SAMUEL BELL,
U. S. Commis

[illegible] according to law, says that he is one
[illegible] facts stated in the foregoing answer, s
[illegible] true, and that the things therein state
[illegible] of his knowledge, information, and
JOHN A. BOU

[illegible] 7th day of October, A. D. 1885.

CHAS. DAY, *N. P.*,

[illegible] D.—THE ARGUMENT.

[illegible] States for the district of New Jersey, in th
circuit.

[illegible] New Jersey, informant, *vs.* The American
[illegible] John A. Bouker, defendants.

Statement of the case.

[illegible] were commenced in the court of chancery f
[illegible] removed into this court.
[illegible] attorney-general of the State of New Jer
[illegible] the defendants be restrained from construct
[illegible] towards Petty's Island, which dike is int
[illegible] the eastern channel, so as to deepen the west
[illegible] city of Philadelphia; and stating that the
[illegible] the ground lying in the Delaware River opposit
[illegible] its, and that the State of New Jersey has "a
[illegible] the waters crossing the said ground and soil, w
[illegible] navigable waters; and has full right and pow
[illegible] waters, and to prevent the erection of obstructions

[illegible] will render the supply of water for the city of Ca
[illegible] will lessen the depth or the channel of the river o
[illegible] stroy the business and commerce of the city of Ca
[illegible] swer state that the act complained of is the buildi
[illegible] toward towards Petty's Island; that this is done u
[illegible] States, in pursuance of an act of Congress, and unde
[illegible] War, and that the Delaware River opposite the ci
[illegible] navigable waters of the United States connecting
[illegible] between the States of Pennsylvania, New Jersey,

Argument.

[illegible] the first article of the Constitution of the United Sta

[illegible] power * * * to regulate commerce with forei
[illegible] States, and with the Indian tribes."
[illegible] case of Miller *vs.* Mayor of New York, 109 U. S., 395

[illegible] Congress to regulate commerce with foreign nations
[illegible] includes the control of the navigable waters of the Un
[illegible] necessary to insure their free navigation; and by 'navi
[illegible] States' are meant such as are navigable in fact, and whic
[illegible] connection with other waters, form a continuous channel
[illegible] countries or among the States."
[illegible] opposite the city of Philadelphia, is a part of such navi
[illegible] States.

By the provisions of the act of Congress approved July 5, 1884, 23 St., 138, an appropriation was made for improving the Delaware River, in these words:

"Improving Delaware River, from Trenton, New Jersey, to its mouth, continuous improvement, two hundred thousand dollars: *Provided*, That not exceeding ten thousand dollars of said sum shall be expended above Bridesburg."

By the same act it was provided that the money appropriated by this act was "to be expended under the direction of the Secretary of War." 23 St., 133.

The act complained of is the building of a dike in the Delaware River at a point where it is a part of the navigable waters of the United States. This work is being constructed by the defendants under a contract with the United States, in pursuance of the above act, and by the direction of the Secretary of War.

The work being constructed is thus brought clearly within the provisions of the Constitution, as laid down in the case of Miller *vs.* the Mayor of New York, and of South Carolina *vs.* Georgia *et al.*, 93 U. S., 4.

This last case is similar to and decisive of the present.

The court says:

"That the power to regulate inter-State commerce and commerce with foreign nations, conferred upon Congress by the Constitution, extends to the control of navigable rivers between States—rivers that are accessible from other States, at least to the extent of improving their navigability—has not been questioned during the argument, nor could it with any show of reason. From an early period in the history of the Government it has been so understood and determined."

* * * * * * *

"But it is insisted on behalf of the complainants that, though Congress may have the power to remove obstructions in the navigable waters of the United States, it has no right to authorize placing obstructions therein; that, while it may improve navigation, it may not impede or destroy it. Were this conceded, it could not affect our judgment of the present case. The record exhibits that, immediately above the city of Savannah the river is divided by Hutchinson's Island, and that there is a natural channel on each side of the island, both uniting at the head. The obstruction complained of is at the point of divergence of the two channels, and its purpose and probable effect are to improve the southern channel at the expense of the northern by increasing the flow of the water through the former, thus increasing its depth and water-way, as also the scouring effects of the current. The action of the defendants is not therefore the destruction of the river. True, it is obstructing the water-way of one of its channels, and compelling navigation to use the other channel; but it is a means employed to render navigation of the river more convenient—a mode of improvement not uncommon."

"The two channels are not two rivers, and closing one for the improvement of the other is in no just or legal sense destroying or impeding the navigation."

It was also decided in this case, that where an appropriation was made by Congress, to be expended under the direction of the Secretary of War, the authority was given to him to construct a work which might divert the water from one channel to another.

In this same case the question arose whether the ninth section of the first article of the Constitution of the United States, which provides that no preference shall be given by any regulation of commerce or revenue to the ports of one State over those of another, was not applicable to the case then before the court, page 12. See also State of Pennsylvania *vs.* Wheeling and Belmont Bridge Co., 18 How., 433, where it is said that "there are many acts of Congress passed in the exercise of this power to regulate commerce, providing for a special advantage to the port or ports of one State, and which very advantage may incidentally operate to the prejudice of the ports in a neighboring State, which have never been supposed to conflict with this limitation upon its power. The improvement of rivers and harbors, the erection of light-houses and other facilities of commerce may be referred to as examples."

The complainant in this case, the State of New Jersey, has no such property right, nor has it alleged that it will sustain such special and peculiar injury as will enable it to maintain its action in this case.

City of Georgetown *vs.* The Alexandria Canal Co., 12 Pet., 99; South Carolina *et al.* *vs.* Georgia, 93 U. S., 14.

JOHN K. VALENTINE,
Attorney for Defendants.

SCHEDULE E.—LETTER OF THE HON. W. J. SEWELL.

CAMDEN, N. J., *September* 30, 1885.

MY DEAR SIR: I have the honor to call your attention to the improvement of the Delaware River, north of Camden and Philadelphia, lately commenced by the Engineer Department, under the charge of Colonel Robert, of the Engineer Corps. This improvement contemplates a dike from Fisher's Point, on the New Jersey s point in the Delaware River, running about 3,500 feet.

The city of Camden and the shore-owners, believing that this work wou what is now the main channel of the Delaware River at that point, and thr tirely on the Pennsylvania side, to the disadvantage of all property, and to age of the water used by the citizens of Camden, applied for and obtained a te injunction restraining the work.

I have examined into the matter of late, and find, from the opinion of thos tomed to the tides and the action of the river in this locality, that this work, i out, will result in the following damage to the interest on the New Jersey sh

1st. It would destroy the channel on this side, making shoal water on a tensive river-front, and of what is now the ship-channel;

2d. It will, eventually, have the effect of filling up the navigable stream of Creek, on which there is a large number of factories;

3d. It interferes with the private rights of people who own land there, and larly those firms engaged in the manufacture of brick, which is a large ind this locality. At what is known as "Fish House," this work, if carried out utterly destroy their water communication; and

4th. What excites the attention of the citizens most, is the possible destru our water supply, which is taken from the water that would be shoaled by the of this dike.

Presuming that our State courts will not have the jurisdiction to prevent t partment from carrying out a public improvement of this kind, I beg that bef work is renewed the board of officers that adopted the plan be re-convened, or ilar one created to take into consideration the points named by me. Our citiz very much excited in relation to the matter, and your compliance with my r would be gratifying to them.

Very respectfully, yours,

W. J. SEWELL,
U.

Hon. W. C. ENDICOTT,
Secretary of War.

REPORT OF LIEUTENANT-COLONEL HENRY M. ROBERT, CORP ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., October 9, 18

SIR: I have the honor to submit the following remarks upon th ter of Hon. W. J. Sewell to the honorable the Secretary of War, ref to me by your indorsement, dated October 3, 1885:

The dike complained of is to extend from Fisher's Point, New sey, 3,000 feet toward the head of Petty's Island, with a mattres about 3 feet thick, projecting 500 feet farther, leaving an open cha way of about 3,000 feet between the end of the sill and the islan 3,500 feet between the end of the dike and the island. The top o dike is to be at the level of mean low water, allowing the tides to over it. The dike will cut off the least important of the two cha between Fisher's Point and Petty's Island.

The dike is a portion of the plan of the Board of Engineers on the manent improvement of the Delaware River appointed last year, a evidently designed to throw more water into the channel west of ty's Island. The project for its construction was approved by the orable the Secretary of War, May 2, 1885, and contracts were mad der which work was commenced on the dike last August, but an in tion served on the contractors September 4, put a stop to the The case is now before the United States circuit court. When sto the condition of the work was as follows: The contractors for dred west of Petty's Island had placed about 26,000 cubic yards of grav the line and in the vicinity of the dike, being about one-third of contract. The contractors for building the dike had, I understand, large quantities of brush cut at various points, and had arrangements completed, they claimed, to deliver material and put in 100 feet of dike per day within a week of the time when they were stopped, but they had not yet put any material into the water.

The objections to the dike, as stated in the letter referred to me, are four in number, and my remarks will be in the same order as the objections.

(1) **Objection:** "It would destroy the channel on this side, making shoal water on a very extensive river-front, and of what is now the ship-channel."

Remarks: The object of the dike is to throw more water into the channel west of Petty's Island, and it will undoubtedly diminish the flow east of the island, but I cannot see that this diminution will produce the disastrous effects claimed.

(2) **Objection:** "It will eventually have the effect of filling up the navigable stream of Cooper's Creek, on which there is a large number of factories."

Remarks: It seems to me that the effect of the dike on Cooper's Creek would be just the opposite to the one here mentioned. In order to see the effect, let us suppose the dike to be built entirely over to Petty's Island, and to be raised above high water. We would then have a cul-de-sac in which the flood tide would rise higher than at present, forcing an increased amount of water up Cooper's Creek, and thus increasing the working force of the ebb tide, tending to scour out the creek to an increased depth. In so far as the dike will have any effect upon Cooper's Creek, it will, in my opinion, be to improve the creek by increasing the working force of the tide in the creek.

(3) **Objection:** "It interferes with the private rights of people who own land there, and particularly those firms engaged in the manufacture of brick, which is a large industry in this locality at what is known as 'Fish House.' This work, if carried out, would utterly destroy their water communication."

Remarks: Every improvement of this nature necessarily interferes with private rights. In the course of time it is to be expected that the area immediately behind the dike will be partially filled up and the deep water be further removed from the present shore. At present it is difficult to foresee what damages may result to owners of adjacent lands, but it would seem only equitable that they should be fully recompensed for any actual damage suffered from the construction of the dike.

(4) **Objection:** "What excites the attention of the citizens most is the possible destruction of our water supply, which is taken from the water that would be shoaled by the action of this dike."

Remarks: Even supposing that the dike would destroy the water supply of Camden or Philadelphia, it would be a question as to whether the use of great navigable rivers for supplying the water-works of cities should take the precedence of their use for navigation. If the dike causes the extensive shoaling feared by the authorities of Camden, it would be a question whether it would not be a blessing in disguise to the water-works by preventing the construction of manufactories between the water-works and the dike, which would probably pollute the river more than the shoals.

But while the dike must necessarily reduce the amount of water flowing through this channel, and therefore produce some shoaling, and I

upon the purity of the wat
ke will be so small as to s
problem of how to improve tl
the effect of the dike is co
piers to the wharf lines on
the accompanying chart, and
ories which, as stated in the
Cooper's Creek, the mouth of
rks, both of which in time a
ties like Camden and Philad
the construction of the dike
ted from other improvements nat
large cities.
edient servant,

HENRY M. ROBERT,
Lieut. Col. of Engin

s, U. S. A.

REPORT OF BOARD OF ENGINEERS

ENGINEER OFFICE, U. S. ARMY,
Philadelphia, Pa., October 28, 18

Engineers constituted by Special
Engineers, series of 1884, for the pu
permanent improvement of the Dela
to Delaware Bay, and re-convened by
rs Corps of Engineers, October 22, 188
certain objections made by citizens of
tion of a dike which the Board had re
er's Point, New Jersey, 3 or 4 miles above
000 feet towards the head of Petty's Isl
as follows:

REPORT.

e United States Engineer Office in Philadel
6, the day appointed. Present, all the mem
the papers submitted for their consideratio
s, Senator Sewell, of New Jersey, Mr. Armstr
ckner, and others personally appeared befor
statements of the damage which they believe
sented would sustain by the completion of the
statements indicated great opposition to the w
ore general and convenient hearing might be g
den, N. J., it was arranged that a public mee
o'clock on the following morning, at the offi
that city, which all interested persons should b
a full and detailed presentation of their views.
The Board met at the time and place appoi
stimony of all who wished to appear before th
company with many of the citizens interested,
ed the site of the proposed work and the New Je

Channel. On their return to Philadelphia, the same afternoon, Mr. Browning appeared before the Board, and gave oral testimony concerning the fishing interest that would be affected by the proposed work at Fisher's Point. After discussing the testimony which had been offered, and agreeing upon their report, the Board adjourned, having first learned, in consultation with the local engineer, that there was no other question of improvement which needed their attention at this time other than the one especially referred to them by the Chief of Engineers.

At the session held at Senator Sewell's office the following gentlemen appeared and presented their objections to the proposed construction, namely:

1. Augustus Reeve, representing the brick-yard interests.
2. J. B. Wood, representing the ship-yard interests.
3. Captain John B. Adams, shipmaster.
4. Mr. Dialogue, councilman, water committee.
5. N. J. Meade, State board of health.
6. Mr. Bacot, engineer, riparian commission.
7. John S. Shultz, city surveyor.
8. H. M. Birkenbine, C. E.
9. Charles G. Darrach, C. E.
10. Senator Sewell, of New Jersey.

The following spoke in favor of the work:

1. Representative Charles O'Neil, of Philadelphia.
2. Mr. Tucker, port warden of Philadelphia.

Many others were present on both sides, but did not present their views.

The objections offered to the prosecution of the work are based upon the fear that it will damage—

(1) The brick-yard property and the fishery at Fisher's Point, by causing the water to shoal in front of these yards, lying just below Fisher's Point, which would compel the extension of their wharves or landing places.

(2) The ship-yard property, by causing the shoaling of the water in front, which might result in destroying their business.

(3) Cooper's Creek, where now there is a large amount of commerce, by causing its mouth to fill up.

(4) The water supply of the city of Camden, by reducing the flow of water through the New Jersey Channel to such an extent that a marsh would gradually form behind the dike, which would catch sewage and other impure matter that would otherwise float away, and thus the city water, which is taken out of this channel, would be rendered unfit for use, and the water-works would therefore have to be removed, at a cost of $1,000,000 probably.

(5) The health of the city, in the same way, by the formation of this marsh, which would produce malaria.

After careful consideration of the subject, the Board cannot bring themselves to view these objections in the serious light in which they seem to be regarded by the gentlemen who presented them; and it appears to be more than probable that much of the importance which has been attached to them has arisen from the belief that the contemplated dike was to be (as was erroneously stated in the information laid before the chancellor of the State of New Jersey, upon which an injunction was obtained) a solid high-water dike extending from Fisher's Point to the head of Petty's Island, completely closing the channel. On the contrary, the proposed dike is to be a low-water dike over which the tide

[illegible] to extend only about half wa
[illegible] and Petty's Island.
[illegible] formed between this dike and th
[illegible] which may finally result in fillin
[illegible] and other property may be affect
[illegible] time only will determine.
[illegible] that the work proposed will red
[illegible] through the New Jersey ch
[illegible] any of the other interests r

[illegible] when, through changes in the regi
[illegible] necessary to close this channel comp
[illegible] channel, some of the evils now
[illegible] that contingency, and in the event
[illegible] doubtless be willing to afford relief f
[illegible] interests of commerce and navi
[illegible] to inflict.
[illegible] Board that there are any other means
[illegible] the requisite channel depth in thi
[illegible] those which they have heretofore pro
[illegible] therefore, that the construction of the Fi
[illegible] and completed.

WM. P. CRAIGHILL,
Lieut. Col. of Engine
WALTER MCFARLAND,
Lieut. Col. of Engine
G. L. GILLESPIE,
Major of Enginee
W. H. HEUER,
Major of Enginee

[illegible] NEWTON,
[illegible] *U. S. A.*

[illegible] COLONEL WILLIAM P. CRAIGHILL, COR ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., October 31, 18

[illegible] forward herewith the report of the Boar
[illegible] of the Delaware River, dated Octobe
[illegible] of place to call attention to the following po
[illegible] consideration:
[illegible] opposition has been made is to be to the he
[illegible] of New Jersey already allows the introdu
[illegible] considerable portion of the length of this dik
[illegible] water, or higher if the riparian owner should so de
[illegible] the line of the proposed dike, but along the w
[illegible] below it.
[illegible] that a much larger interference is thus autho
[illegible] New Jersey with the tidal reservoir on the New Je
[illegible] than may be reasonably expected from the
[illegible] Fisher's Point.
[illegible] improvement, of which the dike is an important
[illegible] maintenance of a channel on the Philadelphia si

o tide towards the Philadelphia side, it is reasonable to believe the s to the New Jersey side will not be material after the expected rease of depth is attained above and below Petty's Island.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

rig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., November 6, 1885.

IR: I have the honor to submit the inclosed copy of the Report of ard of Engineers reconvened with your sanction by Special Orders , Headquarters Corps of Engineers, dated October 22, 1885, to coner and report upon certain objections urged by the Hon. W. J. Sewell, ited States Senator from New Jersey, and others, to the proposed -water dike now in course of construction between Fisher's Point d Petty's Island, in the Delaware River above Camden, N. J.

It will be seen that the Board has given patient consideration to the jections urged by the citizens of Camden, many of whom presented eir views in person, and report that they "cannot bring themselves view these objections in the serious light in which they seem to be garded by the gentlemen who presented them, and it appears to be ore than probable that much of the importance which has been atched to them has arisen from the belief that the contemplated dike as to be (as erroneously stated in the information laid before the hancellor of New Jersey, upon which an injunction was obtained) a lid high-water dike extending from Fisher's Point to the head of Pet- Island, completely closing the channel. On the contrary, the pro-

In this connection, attention is respectfully invited to the l
Lieut. Col. W. P. Craighill, Corps of Engineers, President of the
dated the 31st ultimo, submitting the report.

Previous papers herewith.

Very respectfully, your obedient servant,

JOHN NEWTON,
Chief of Engineers,
Brig. and Bvt. Maj. G

Hon. WM. C. ENDICOTT,
Secretary of War.

WAR DEPARTMENT, *November* 9, 1

Approved.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Cle

REPORT OF LIEUTENANT-COLONEL HENRY M. ROBERT, CORI ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., February 20, 1

SIR: In compliance with your indorsement of the 12th instant, o
letter of Mr. W. R. Tucker, I have the honor to submit the follo
report with estimate of the cost of improving the channel over Sn
Island Bar in the Delaware River.

Smith's Island Bar lies in the middle of the Delaware River bet
Philadelphia, Pa., and Camden, N. J. It is about 1½ miles in le
between the 6-foot curves and covers about three-fourths of the
front of Camden. The mass of the commerce that crosses the river
Pennsylvania to New Jersey at Philadelphia must cross this bar,
at mean low tide does not afford a channel of 2 feet depth. The U
States spent $10,000 in 1883–'84 in dredging a channel of 10 feet
across this bar just above Smith's Island, but it has since filled
that I understand there is not now more than 2 feet at low water a
locality. A narrow canal has been cut and maintained between Sn
and Windmill islands, which form a part of this bar, by the ferry
panies.

The channel formerly dredged by the United States and the n
canal maintained in the interest of the ferry companies have both
cut at right angles to the general axis of the river, and therefore
not be kept open by the currents.

On the accompanying tracing is shown the location of the cut a
this bar that I would propose as the best solution of the problem. Th
current would help keep it open, while the flood would not injuri
affect it. I would aim at maintaining a low-water channel of 1
depth and at least 200 feet wide, and would therefore propose to d
a channel of 200 feet width to a depth of 12 feet, and to protect
channel by a simple revetment.

The estimated cost of this work is $40,000, of which $20,000
dredging 100,000 cubic yards of sand, and the remainder for cons
ing 2,000 feet of revetment. The entire amount should be appropr
at one time.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col. of Engine

The CHIEF OF ENGINEERS, U. S. A.

COMMERCIAL STATISTICS.

(Above Philadelphia.)

Vessels arriving at and departing from the Delaware and Raritan Canal at Bordentown during the year ending December 31, 1885.

Description.	Arrivals.			Departures.		
	Number.	Tonnage.	Average crews.	Number.	Tonnage.	Average crews.
Steamers	770	91,558	8	741	75,801	8
Sailing vessels	154	23,369	3	7	452	3
Barges	2,831	502,262	2	1,727	210,635	2
Rafts	89	5,302	2	1	68	2
Totals	3,844	622,486	....	2,476	286,456	....

A total of 6,320 loaded vessels carrying 908,942 gross tons of freight. The estimated value of shipments arriving, 622,486 tons, was $12,724,908, and that of departing, 286,456 tons, at $9,259,823, a total of $21,984,731.

The canal collector at Bordentown estimates the tonnage by water, to and from Bordentown, for the year ending December 31, 1885, not entering the canal and therefore not included in above statement, at 227,000 gross tons. This would make the aggregate tonnage of the Delaware River at Bordentown 1,135,942 tons.

In addition to the foregoing, several steamboats run daily during the season of navigation between Philadelphia and points on the river above, carrying a large number of passengers and considerable freight.

The above information was furnished by Mr. G. M. Taylor, auditor of freight receipts, Pennsylvania Railroad Company.

Statement of tonnage over the piers of the Philadelphia and Reading Railroad Company, on the Delaware River Front, at Port Richmond, during the year ending December 31, 1885.

	Tons.
Anthracite coal	1,777,522
Other merchandise, including 2,827,789 bushels of grain	450,000
Total	2,227,522

Estimated statement of vessel movement to and from Port Richmond piers during the year ending December 31, 1885.

	Vessels.
For movement of coal	7,463
For movement of grain	284
For movement of general merchandise	366

The above information was furnished by Mr. Frederick W. Taylor, of the Philadelphia Grain Elevator Company.

Domestic and foreign entrances and clearances, 1885.

(Below Philadelphia.)

With and without cargoes.	With cargoes.		With ballast.	
	Vessels.	Tons.	Vessels.	Tons.
American vessels entered from foreign ports	433	210,023	4	3,560
American vessels cleared for foreign ports	269	153,764	18	6,359
Foreign vessels entered from foreign ports	743	770,958	107	92,634
Foreign vessels cleared for foreign ports	763	771,997	25	23,241

Coastwise entrances and clearances, 1885.

Class of vessels.	Entered.
Steamers	1,633
Ships	25
Barks	42
Brigs	20
Schooners	3,008
Total	4,728

Export of grain and petroleum during 1885.

Wheat	bushels..	3,3
Corn	do....	6,0
Petroleum	barrels..	2,9

The above information was furnished by the Philadelphia Maritime Exchan

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F 2.

IMPROVEMENT OF DELAWARE RIVER AT SCHOONER LEDGE, PENN VANIA AND DELAWARE.

No work was done at this locality during the past fiscal year.
appropriation of $40,000, August 2, 1882, was the last made specific
for this work, and available funds were practically exhausted du
the working season of 1884. . The total amount expended has b
$170,000, and has resulted in the formation of a channel 330 feet w
and 24 feet deep at mean low water through the rocky ledge.

The improvement of this locality is considered in the Report of
Board of Engineers of 1884 for the permanent improvement of D
ware River and Bay, and will be found in the Report of the Chief of
gineers, 1885, page 822. This report shows that to obtain at this lo
ity a channel 600 feet wide and 26 feet deep, at mean low water, wo
require the removal of about 20,000 cubic yards of rock and 46,133
bic yards bowlders, gravel, and sand, at an estimited cost of $449,0

The improvement of Schooner Ledge should form a part of the co
prehensive plan for the permanent improvement of the Delaware Ri
as recommended by the Board of Engineers of 1884, and no approp
tion is asked for under the above title, since it is for the best intere
of the work and of commerce that all funds for the improvement of
main ship-channel of the river be appropriated under the general ti
of "Improvement of Delaware River from Trenton, N. J., to its mout

This work is situated in the collection district of Philadelphia, which is the nea
port of entry. The amount of revenue collected at that port during the year end
December 31, 1885, was $13,801,190.61. The nearest fort and light-houses are, resp
ively, Fort Mifflin and the Schooner Ledge range lights.

Total appropriations to June 30, 1886	$170,00
Total expenditures to June 30, 1886	170,00

Money statement.

July 1, 1885, amount available	$162
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	162
Amount (estimated) required for completion of existing project	(*

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*Included in amount required for completion of existing project, "Delaware Ri
from Trenton, N. J., to its mouth."

F 3.

IMPROVEMENT OF DELAWARE RIVER NEAR CHERRY ISLAND FLATS, DELAWARE.

No work was done at this locality during the past fiscal year. The appropriation of $100,000 of August 2, 1882, was the last made specifically for this work, and available funds were practically exhausted during the working season of 1883. The amount expended has been $400,000, and was applied to the formation of a dredged channel about 2 miles long, 470 feet wide, and 24 feet deep at mean low water.

The improvement of this locality is considered in the Report of the Board of Engineers of 1884 for the permanent improvement of Delaware River and Bay, and will be found in the Report of the Chief of Engineers, 1885, page 822. This report shows that to obtain at this locality and through the shoal water in its vicinity a channel 600 feet wide and 26 feet deep at mean low water would require the removal of about 828,200 cubic yards of sand and mud, at an estimated cost of $248,460.

The improvement of Cherry Island Flats should form a part of the comprehensive plan for the permanent improvement of the Delaware River as recommended by the Board of Engineers of 1884. No appropriation is asked for under this title, as it is for the best interests of the work and commerce that all the funds for the improvement of the channel of the Delaware River be appropriated under the general title of "Improvement of Delaware River from Trenton, N. J., to its mouth."

This work lies in the collection district of Delaware, with Wilmington as its nearest port of entry, at which the revenue collected during the year ending December 31, 1885, amounted to $12,573.93. The nearest fort and light-houses are respectively Fort Delaware and Cherry Island range lights.

Total appropriations to June 30, 1886	$400,000
Total expenditures to June 30, 1886	400,000

Money statement.

July 1, 1885, amount available	$1,456 74
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	1,456 74
Amount (estimated) required for completion of existing project	(*)

F 4.

IMPROVEMENT OF FRANKFORD CREEK, PENNSYLVANIA.

No work was done on Frankford Creek during the last fiscal year, and no appropriation for its improvement has been made since that of August 2, 1882, appropriating $10,000. This amount was practically expended during the fiscal year ending June 30, 1883, in the formation of a dredged channel 7 feet deep at mean low water, and extending from the mouth of the creek to above Bridge Street Bridge, Bridesburg.

This creek is entirely within the corporate limits of Philadelphia, and it is understood to be regulated by the municipal authorities. It is not considered in the interest of commerce and navigation to recon further appropriations.

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* Included in amount required for completion of existing project, "Delaware River from Trenton, N. J., to its mouth."

Frankford Creek lies wholly within the port of entry of Philadelphia, a the revenue collected during the year ending December 31, 1885, amoun $13,801,190.61. The nearest fort and light-houses are, respectively, Fort Miff Horseshoe range lights.

Total appropriations to June 30, 1886	$10,
Total expenditures to June 30, 1886	9,

Money statement.

July 1, 1885, amount available	$
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	
July 1, 1886, amount available	$
Amount (estimated) required for completion of existing project	30,

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

Arrivals and departures of vessels during the year ending December 31, 1885.

Description.	Arrivals.		Departur	
	No.	Tonnage.	No.	T
Sailing vessels	44	6,600	44	
Barges	6	900	6	
Totals	50	7,500	50	

Imports.

Articles.		Quantity.
Lumber	feet..	1,000,000
Wood	cords..	800
Sand	tons..	2,700
Soda ash	do...	500
Hay	do...	300
Total		....

The above information was furnished by the Mason Fruit Jar Company, of E burg.

F 5.

IMPROVEMENT OF SCHUYLKILL RIVER, PENNSYLVANIA.

Under a contract with the National Dredging Company, dated ber 6, 1884, 36,004 cubic yards were removed during the fiscal year the river between Point Breeze and Girard Point piers. This con was completed July 31, 1885, by the aggregate removal of 88,734 yards, at 28 cents per cubic yard.

stnut street.

he natural character of the banks and the bed and the tidal characstics of the river are such as to render quite permanent the imved channels.

he work which has been done is of great benefit to commerce, and further improvement of the river to the completion of the existing ect would be of great advantage.

uring the fiscal year ending June 30, 1887, available funds will be lied to dredging.

n appropriation of $75,000 is recommended for the fiscal year end- June 30, 1888, and if an appropriation is made it will be applied to lging in furtherance of the approved project.

l appropriations to June 30, 1886	$350,000 00
l expenditures to June 30, 1886	349,615 38

is work lies in the collection district of Philadelphia, at which, as a port of entry, was collected during the year ending December 31, 1885, revenue to the amount 3,801,190.61. The nearest fort and light-houses are, respectively, Fort Mifflin Schuylkill River range lights.

Money statement.

1, 1885, amount available	$11,578 97
1, 1886, amount expended during fiscal year, exclusive of liabilities tstanding July 1, 1885	11,194 35
1, 1886, amount available	384 62
unt appropriated by act approved August 5, 1886	18,750 00
unt available for fiscal year ending June 30, 1887	19,134 62
nount (estimated) required for completion of existing project	116,250 00
nount that can be profitably expended in fiscal year ending June 30, 1888	75,000 00

ıbmitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

The above information was furnished by Mr. G. M. Taylor, auditor freight
Pennsylvania Railroad Company.

Number of vessels and estimated shipments of petroleum from Gibson's Point du year ending December 31, 1885.

Ships	
Barks	
Brigs	
Schooners	
Barges and sloops	
Total vessels	
Total barrels	2

Number of vessels at Point Breeze and total shipments of petroleum during the year December 31, 1885.

Steamships	
Ships	
Barks	
Brigs	
Schooners	
Barges and sloops	
Total vessels	
Total barrels	2,17

Number of vessels at and shipments of grain from Girard Point elevators during the ending December 31, 1885.

Steamships	
Ships	
Barks	
Schooners, sloops, and barges	
Total vessels	
Total bushels grain	6,56
Total tons merchandise	2

Number of vessels arriving at the wharves of the Knickerbocker Ice Company, John & Sons, G. F. Parker, and Harrison Brothers & Co., on Schuylkill River, durin year ending December 31, 1885.

Barks	
Brigs	
Schooners	
Total	
Carrying—	
Brimstone and clay	
Ice	7
Marble	1
Stone	
Total	9

The above information was furnished by Messrs. Peter Wright & Sons, of Phil
phia, Pa.

F 6.

ICE-HARBOR AT MARCUS HOOK, PENNSYLVANIA.

Under an agreement with the American Dredging Company, d
November 16, 1885, 34,000 cubic yards of material, at 20 cents per c
yard, were removed by dredging from the area between the first

second and the second and third pairs of ice-piers. The dredging between the first and second pairs of piers was to a depth of 22 feet, and that between the second and third pairs of piers to a depth of 24 feet below mean low water. The deepened area extended to lines about 25 feet inside of the inner faces of the ice-piers. This dredging renders about two-thirds of the area of the harbor protected by the piers available for vessels drawing from 22 to 26 feet at mean low water.

Under an agreement with Messrs. Davis, Irvin & Sauville, dated November 24, 1885, and for the sum of $298, two groups of mooring piles were placed in the harbor. These groups of piles were placed on the line of the inner ice-piers, one group being midway between the first and second pairs of piers, and the other group midway between the second and third pairs of piers. The distance between the piers on these lines was about 600 feet, and experience had shown that the distance was too great between mooring points. These groups of piles reduce the distance between mooring points to about 300 feet, and are found to add greatly to the value of the harbor.

This harbor is of considerable value to the commerce of the river during the winter season, and at times is filled to its full capacity. Its utility will continue even when the proposed ice-harbor at the head of Delaware Bay is built, since the ice-harbor at Marcus Hook will always be valuable as a refuge for vessels in the upper part of the river.

The inner pier of the third pair shows signs of instability, and may require in the near future extensive repairs. The value of the harbor to vessels seeking temporary refuge from ice is somewhat reduced from the practice of vessel-owners utilizing the harbor as a place in which their vessels are permanently placed during the winter season. This practice, while it enables the owners of such vessels to escape dock and wharf charges, incumbers the harbor unnecessarily, and there should be such legislation as would give the United States authority to appoint a harbor-master, with power to control the harbor.

Available funds were entirely exhausted during the past fiscal year.

During the fiscal year ending June 30, 1888, if funds are available they will be applied to the construction of the bulkhead along the shore front of the harbor and in deepening by dredging the shoal areas of the harbor in accordance with the present project for its improvement.

It is located in the collection district of Philadelphia. This is the nearest port of entry, the collections during the year ending December 31, 1885, amounting to $13,-91,190.61. The nearest fort and light-house are, respectively, Fort Mifflin and Christiana Light.

Total appropriations from 1866 to June 30, 1886	$179,000
Total expenditures from 1866 to June 30, 1886	179,000

Money statement.

July 1, 1885, amount available	$7,438 16
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	7,438 16
Amount appropriated by act approved August 5, 1886	15,000 00
Amount (estimated) required for completion of existing project	35,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	35,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

Abstract of proposals for dredging at the ice-harbor at Marcus Hook, Pa.,
response to circular-letter, and opened November 16, 1885, by Lieut. Col. Hen
ert, Corps of Engineers.

No.	Names and addresses of bidders.	Price per cubic yard.
		Cents.
1	American Dredging Company, Philadelphia, Pa	20
2	William C. Turner, Philadelphia, Pa	22
3	National Dredging Company, Wilmington, Del	20½
4	Frank C. Somers, Philadelphia, Pa	21

Abstract of proposals for placing two groups of mooring piles at the ice-harbor
Hook, Pa., received in response to circular-letter, and opened November 24, 188
Col. Henry M. Robert, Corps of Engineers.

No.	Names and addresses of bidders.	Price.
1	Davis, Irvin & Sauville, Philadelphia, Pa	$298
2	Henhoeffer & Vaughn, Wilmington, Del	450
3	J. Powell & Son, Philadelphia, Pa	350

F 7.

ICE-HARBOR AT HEAD OF DELAWARE BAY, DELAWARE.

The act of August 2, 1882, contained an appropriation of $25
"ice-harbor at head of Delaware Bay, and for removal of sunk
in channel back of Reedy Island, Delaware." The sum of $3,
expended in 1883 in removing the sunken piers at Reedy Isla
$3,800 in surveys and examinations, leaving an available bal
$17,500 at the commencement of the last fiscal year, of which
has since been expended.

The importance of this ice-harbor has been fully set forth in
reports, but the difficulties connected with it are so great that
think there has yet been any satisfactory solution proposed.
the information I have obtained, the inclosing of the area b
rier that will prevent the ingress and egress of ice will be no i
ment upon the plan of detached ice-breakers, as heretofore use
river. But the question of the most economical construction
ice-breakers, whether they should be stone piers, pile-piers, or
pontons, requires more study than has yet been given to the su

It is hoped that a report with plans and estimates may be su
during the ensuing fiscal year.

Money statement.

July 1, 1885, amount available	$
July 1, 1886, amount available	
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	3

SPECIAL REPORT OF LIEUTENANT-COLONEL HENRY M. ROBERT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., November 28, 1885.

SIR: I have the honor to submit the following objections to the special plan of an ice-harbor at Liston's Point, Delaware River, referred to me for report February 14, 1885.

The plan appears to be a modification of the method of two parallel piers perpendicular to the shore, the modification consisting in curving the piers so as to bring the outer ends about one hundred yards apart, this opening forming the entrance to the harbor.

Each pier consists of a series of small iron pile-piers connected by an iron railing, supported at intervals by single iron piles. The railing is sufficiently close and high to prevent the ice from floating through it.

The fundamental idea of the plan appears to be to keep out of the harbor all extraneous ice. This is a great advantage if not obtained at too great cost. Is not the cost, however, greater than the benefit? In order to keep out the extraneous ice it is necessary to confine the inside ice, so that, though repeatedly broken up by the ice-boats, instead of being driven out of the harbor by the current, as at the present ice-harbors on the Delaware River, it would remain to become solid again. It would seem but natural that the ice inside the harbor should be much thicker than what is outside, and prove a serious hindrance to the use of the harbor; but in order to keep out the extraneous ice by a railing it is necessary to make the much more serious sacrifice of suitable entrances to the harbor, leaving only one entrance, and that on the side, so that vessels will have to enter and leave the harbor across the current.

There would be no special objection to the entrance provided it were the entrance to a river, like the harbors on our Northern Lakes. In such case a vessel could approach at full speed on the line of the axis of the entrance with safety, for she would, after entering, have sufficient time to slow down before reaching the harbor proper where vessels lie. But in the ice-harbor, on the contrary, she must enter so slowly as to permit her being brought to a stop within 200 or 300 yards to avoid collision. While running at this slow speed the vessel may have to contend with a strong cross-current containing floating ice, rendering the entrance very difficult, which difficulty would be greatly increased if at the same time a strong easterly wind were blowing.

The Oswego Harbor, with an entrance 350 feet wide, and a bad cross-current at times, is a somewhat similar case to this, and vessels are obliged to keep up full speed in order to make that entrance.

In the plan of ice-harbor used at Marcus Hook there is a clear space of 100 feet between adjacent piers, allowing a vessel to choose between several entrances, and to enter and leave the harbor against the current, so that the vessel is manageable at slow speed, and this advantage should be retained unless at the sacrifice of something still more important. This plan has appeared to work well in the past, and I have been unable to get at facts that would justify the proposed change of plan.

As far as the details of the plan are concerned, I have only given them sufficient study to make me feel very doubtful as to the piers and barriers being strong enough to do the duty required of them. The screw piles at Lewes could not be forced into the hard bottom, where the water-jet could not be used. At the site at Liston's Point the hard bottom is from 20 to 60 feet below mean high water, and it does nc to me that even the piers, as projected, much less the intermedia barrier, would stand the shocks of vessels and ice to which the be exposed.

The barrier, or railing, is an indispensable part of the propose the piers being too small to afford protection to vessels, as is c the piers at the existing ice-harbors. If the barrier is abando whole plan goes with it.

The expense of the construction at such a locality of masonry p at Marcus Hook, would be very great, and it is probable that a c pier of iron could be devised that would be a suitable substitute as the only directly useful portion of these piers is that from, s or three feet below low water upwards, the rest of the pier only s as a means of connection with the river bottom, the question na rises whether the pier could not be economically replaced by a fl ponton heavily anchored. It seems to me that all needed pro from the ice can be obtained in this manner at much less cost t piers of iron or masonry, considering the great depth to hard b

If the present proposed plan is not adopted, I would propose to out the details of a plan for utilizing pontons in the formation of harbor at Liston's Point.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col. of Engin

The CHIEF OF ENGINEERS, U. S. A.

F. 8.

CONSTRUCTION OF IRON PIER IN DELAWARE BAY, NEAR LEWES, WARE.

No work has been done during the past fiscal year. The last a priation was $13,000, made August 2, 1882, and was applied to th pair of the wooden superstructure, which was but partially compl

The decay of timber in the superstructure of the pier is very r and to make the pier of value, the superstructure must be maint with unimpaired strength. Parts weakened by decay must be rem early in their deterioriation, and be replaced by sound material. renders the life of the timber of short duration and consequently cost of maintenance large.

The railroad having its terminus in the vicinity of the pier ha vived the question of using the pier in connection with their tra privilege granted by the act of July 15, 1870. The present woode perstructure was designed several years ago and before the ado of the present heavier weights of engines and rolling stock. The creased weights render the present plan of wooden superstructur tirely too light for the increased loads which would be brought the pier in its use by the railroad company.

To add to the quantity of perishable material in a wooden s structure would be only to increase largely the cost of its mainten

The plan as described in the project appended hereto propose iron superstructure with paved surfaces outside of the areas occ by the railroad tracks upon the pier-head, and an iron superstru carrying the track upon the approach to the pier-head, combined the use of timber for the deck-covering over that part of the area of the approach not occupied by the railroad tracks. Such an iron superstructure, with a strength fully equal to the requirements of railroad traffic, could be built for about $93,000, and maintained at a trifling cost for repairs, rendering available the permanent iron substructure, which has been built at a cost of over $300,000.

A wooden superstructure, giving the same strength when new as the proposed iron superstructure, would cost at first probably $40,000, and would practically have to be entirely removed each ten years, so that its aggregate cost would in the end exceed that of an iron superstructure. Even with the above expenditure for repairs, the wooden superstructure would frequently be in a condition of impaired strength.

Should the project for the iron superstructure, which is appended hereto, be approved, an appropriation of the entire amount, namely, $93,000, is recommended for the fiscal year ending June 30, 1888, as when the change of superstructure is begun the pier will be useless until the new superstructure is completed.

The pier is in the collection district of Delaware, the nearest port of entry being Wilmington, where the amount of revenue collected during the year ending December 31, 1885, was $12,573.93. The nearest fort and light-house are, respectively, Fort Delaware and the Delaware Breakwater Light.

Total appropriations to June 30, 1886	$368,500 00
Total expenditures to June 30, 1886	368,312 86

Money statement.

July 1, 1885, amount available	$887 28
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	700 14
July 1, 1886, amount available	187 14
Amount (estimated) required for completion of existing project	15,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	15,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

SPECIAL REPORT OF LIEUTENANT-COLONEL HENRY M. ROBERT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., April 2, 1886.

SIR: I have the honor to submit the following report, in compliance with your indorsement on a copy of the resolution of the Senate of the United States, as follows:

IN THE SENATE OF THE UNITED STATES,
March 12, 1886.

Resolved, That the Secretary of War be, and he is hereby, directed to cause an examination to be made of the "Government pier" on the Delaware Bay, near Lewes, in the county of Sussex and State of Delaware, with the view of ascertaining the probable cost of completing the superstructure thereof wholly of iron, so as to render the same available for the interchange of traffic and promotion of commerce, as contemplated by the act of Congress authorizing its construction; and that he furnish to the Senate, as early as practicable, an estimate of the cost [of] so completing the same.

Attest:

ANSON G. MCCOOK,
Secretary.

The act of July 15, 1870, authorizing the construction of the Pier, in section 12 provides for "a good and substantial pier o: or iron," and in section 13 makes it lawful for the "Junction and water Railroad, in the State of Delaware, to extend their railroa and upon said pier, and freely to use said pier in connection wit said road, subject to such regulations and charges for maintenan repairs as the Secretary of War may adopt."

The object of the resolution, then, is to ascertain the cost of com the pier with an iron superstructure sufficiently strong for r traffic.

The present pier substructure consists of iron screw piles, arr as follows:

From the shore line outward for a distance of 1,155 feet the sub ture is 21 feet wide; the piles arranged in bents of three piles, 1 between centers, on lines transverse to the axis of the pier; the are 21 feet apart. Beyond this narrow part the pier increases to a of 42 feet for a further distance of 546 feet, making a total len pier of 1,701 feet. The wide part is known as the "pier-head," an the piles are placed on transverse and longitudinal lines the sam tance apart as in the narrow or shore arm of the pier.

In the plan proposed for the iron superstructure the shore-arm pier is arranged for a line of single track, the pier-head for a d track. The track on the shore-arm is carried by two built iron gi resting upon rolled I beams, placed tranverse to the axis of the and bearing upon the iron piles of the substructure. The de this part of the pier may be planked, or it may be paved with blocks, or asphaltum, supported by iron buckle-plates, as provid in the estimates which follow.

The superstructure of the pier-head would consist of five long nal iron girders resting upon the pile-caps, giving support to trans I beams, which, in turn, carry the longitudinal I beams supportin tracks. The deck of the pier-head outside of the tracks wou paved with stone blocks or asphaltum, supported by buckle-p resting upon the longitudinal girders and the transverse I beams. superstructure of the pier-head should be sufficiently strong to bea severest strain that will be imposed on it, which would be when tracks are covered with the heaviest loaded box-cars, say 35 tons and the rest of the pier-head loaded with freight to the extent o pounds per square foot. The piles have been tested to this e without moving, and the estimates herewith are based on a cons tion to carry this strain with a coefficient of safety of from 4 to 5.

The following estimates are based upon present prices, with suffi allowance for the probable fluctuations of one season. They do n clude the cost of railroad ties and rails, which, as I understand th authorizing the construction of the pier, are not to be put down b Government:

ESTIMATES.

Cost of superstructure for single track on 1,155 linear feet of pier, and for doubl on pier-head 546 feet long, areas outside of tracks to be paved with stone blo asphaltum resting on iron buckle-plates.

1,600,000 pounds iron (girders, I beams, and buckle-plates), at 5 cents per pound	$
3,200 square yards paving, at $3 per square yard	
Contingencies	
Total	1

If the paving, together with the necessary iron work to support the same, is omitted from the 1,155 linear feet of pier leading to the pier-head, and is replaced by a wooden decking, the estimate would be as follows:

1,500,000 pounds iron (girders, I beams, and buckle-plates), at 5 cents per pound	$75,000
1,200 square yards paving on pier-head, at $3 per square yard	3,600
75,000 feet, B. M., pine timber for roadway decking on approach to pier-head, at $40 per 1,000 feet, B. M	3,000
Contingencies	11,400
Total	93,000

The water is so shallow that no vessels would be unloaded along the narrow portion of the pier comprising the approach to the pier-head, and the roadway on this part of the pier would have very light use and bear no heavier weight than occasional teams, so that it is probable that the last plan would answer every purpose of commerce at a diminished cost. Should it ever become advisable to make a stone or asphalt roadway on the approach to the pier-head it could be done at any time.

When the work is commenced the pier will be useless until it is entirely completed, so that it is of great importance that the entire amount should be appropriated at one time.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

F 9.

IMPROVEMENT OF HARBOR AT DELAWARE BREAKWATER, DELAWARE.

The last appropriation for this work was $75,000, made by the act of July 5, 1884.

During the past fiscal year the work in progress has been the closing of the gap, in accordance with the present project, between the breakwater and the ice-breaker. In the previous work done under this project, a mattress sill 90 feet wide and 2 feet thick had been placed along the axis of the gap and covered with stone.

Under the contract with Messrs. Andrews and Locke, dated December 16, 1884, 20,277 tons of stone were placed in the gap during the fiscal year. This contract was completed January 2, 1886, by the total delivery of 23,277 tons of stone.

On January 20, 1886, proposals were invited for about 10,000 tons of stone and a contract therefor entered into under date of March 4, 1886, with William M. Field, at the rate of $2.24 per gross ton.

Under this contract 10,062 tons were delivered, completing the contract on June 9, 1886, and making a total of 30,339 tons delivered in the gap during the past fiscal year under these two contracts. This work practically exhausted the funds available from the appropriation of $75,000 made July 5, 1884.

A recent study of the present sections of the breakwater and ice-breaker gives the following results: On the ice-breaker the mean slope on the harbor side is 1 vertical upon 1.3 horizontal, and on the outer slope 1 vertical on 2 horizontal. The breakwater, which is more directly subjected to wave-action and upon which the sea slope was possibly placed flatter than in the case of the ice-breaker, has upon the harbor face a mean slope of 1 vertical upon 1 horizontal, and on the sea

face a slope of 1 vertical upon 2.2 horizontal above mean low wa
1 vertical to 2.8 horizontal from mean low-water plane to the b

The mean cross-section of the ice-breaker has a width on to
feet and on bottom of 156 feet, with a height of 40 feet, giving
cross-sectional area of about 396 square yards.

The mean cross-section of the breakwater has a width of 22
top and 176 feet on bottom, with a height of 42 feet, giving
cross-section of about 456 square yards.

The calculated volumes of the works, including voids, are as f

	Cu
Ice-breaker, including ends..	
Breakwater, including ends	
Total	

The quantity of stone placed in the work was 892,528 gross t
about 441,000 cubic yards of solid measurement.

The importance of this work to both the commerce of the De
River and the Atlantic coast is such as to justify sufficient app
tions to complete the breakwater by closing the gap at the earlie
possible.

The reports of the Maritime Exchange state that during th
1885 1,701 vessels, exclusive of tugs, fishing and small coasting
anchored under the protection of the breakwater. This number i
much smaller than that stated in the annual reports for previous
The practice of the past seems to have been for the keeper of the
water light to count each morning the vessels lying at anchor a
report the same as the number of vessels seeking the protection
breakwater. By this method a vessel remaining at the break
several days awaiting orders, or through stress of weather, was co
repeatedly. The method adopted by the Maritime Exchange c
each vessel but once, regardless of the length of stay at the break
This difference in the methods of reporting the number of vessels
ing the breakwater for protection, and the omission of tugs, fishin
small coasting craft which were formerly reported, will count fo
difference between the past and present reports.

It is recommended that an appropriation of $300,000 be made fo
tinuing the work.

This work is situated in the collection district of Delaware. Wilmington
nearest port of entry, at which the revenue collected during the year ending I
ber 31, 1885, was $12,573.93. Fort Delaware is the nearest fort, and the Brea
Light the nearest light-house.

Total appropriations to June 30, 1886	$2,492,
Total expenditures to June 30, 1886	2,490,
Total appropriations under present project to June 30, 1886	200,
Total expenditures under present project to June 30, 1886	198,

Money statement.

July 1, 1885, amount available	$67,
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	66,
July 1, 1886, amount available	1,
Amount appropriated by act approved August 5, 1886	56,
Amount available for fiscal year ending June 30, 1887	57,
Amount (estimated) required for completion of existing project	418,
Amount that can be profitably expended in fiscal year ending June 30, 1888	300,

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

Abstract of proposals for furnishing and placing stone in the gap at the Delaware Breakwater, received and opened February 19, 1886, *by Lieut. Col. Henry M. Robert, Corps of Engineers.*

No.	Names and addresses of bidders.	Price per ton.	Remarks.
1	John Satterlee, Englewood, N. J	$2 49	No statement of quarries or vessels.
2	John A. Bouker, New York City	2 19	Quality of stone unsatisfactory.
3	Samuel R. Cuming, New York City	2 44½	
4	Henry Opperman, jr., Harrisburg, Pa	4 39	
5	Cal I. Leiper, Chester, Pa., and George M. Lewis, Media, Pa	3 25	
6	James M. Andrews and George Willett Andrews, Biddeford, Me	2 24 2 35	For Delaware River stone. For Maine or Massachusetts granite.
7	William M. Field, Kentmere, Del	2 24	Recommended for acceptance.

Contract (dated March 4, 1886) awarded to William M. Field.

COMMERCIAL STATISTICS.

Statement showing number of vessels calling at the breakwater for harbor and for orders during the year ending December 31, 1885.

Description.	For harbor.	For orders.
Steamers	211	59
Ships	150	25
Barks	828	172
Brigs	194	55
Schooners	318	87
Total	1,701	398

The above information was furnished by the Philadelphia Maritime Exchange.

F 10.

IMPROVEMENT OF RANCOCAS RIVER, NEW JERSEY.

During the past fiscal year no work has been done on this river. The last appropriation ($10,000) was made August 2, 1882, and available funds were practically exhausted during the fiscal year ending June 30, 1883. Twenty thousand dollars have been appropriated for the improvement of this river, and have been applied to the formation of a channel about 100 feet wide and 6 feet deep at mean low water through Coate's Bar, which is about 4 miles above the river mouth, and to the construction of a regulating dike from the north bank of the river to the upper end of Hamill's Island.

No operations are contemplated during the present season, as no funds are available.

In furtherance of the approved project, a channel with a low-water depth of 6 feet, should be dredged through the shoals between Coate's Bar and Centreton at a cost which has been estimated at $22,000. This amount could be profitably expended during the fiscal year ending June 30, 1888.

Rancocas River is in the collection district of Trenton, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December

31, 1885. The nearest fort is Fort Mifflin, and the Horseshoe range lights are nearest light-houses.

Total appropriations to June 30, 1886	$20, 00
Total expenditures to June 30, 1886	19, 89

Money statement.

July 1, 1885, amount available	16
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	66
July 1, 1886, amount available	100
Amount (estimated) required for completion of existing project	62, 000
Amount that can be profitably expended in fiscal year ending June 30, 1888	22, 000

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

Arrivals and departures of vessels during the year ending December 31, 1885.

Description.	Arrivals.			Departures.		
	Number.	* Tonnage.	Crews.	Number.	* Tonnage.	Crew
Steamers (not including tugs)	360	48, 600	1, 570	360	54, 000	1, 5
Sailing vessels	1, 350	65, 000	4, 080	1, 350	83, 000	4, 0
Barges	730	45, 400	1, 300	730	142, 000	1, 3
Canal-boats	1, 380	47, 000	1, 460	1, 380	87, 000	1, 4
Totals	3, 820	206, 000	8, 410	3, 820	366, 000	8, 41

* The tonnage is of the cargoes and not of the vessels.

Exports and imports.

Articles.	Exports.		Imports.	
	Quantity.	Value.	Quantity.	Value.
Brimstone .... tons			800	$18, 400
Cement and plaster .... barrels			2, 000	4, 000
Coal .... tons			8, 500	34, 000
Lumber and timber .... feet			3, 500, 000	160, 000
Laths and shingles			800, 000	7, 500
Lime .... bushels			98, 000	37, 000
Manure .... cart-loads			10, 000	10, 000
Pig-lead .... tons			5	400
Saltpeter and potash .... do			500	20, 000
Salt .... do			100	1, 000
Tin .... do			3	1, 800
Tin .... boxes			2, 000	10, 000
Miscellaneous merchandise				100, 000
Canned goods .... pounds	1, 600, 000	$40, 000		
Fruit .... baskets	20, 000	10, 000		
Fertilizers .... tons	8, 000	240, 000		
Sand (molding) .... do	150, 000	225, 000		
Vegetables .... baskets	40, 000	20, 000		
Total		535, 000		404, 100

The above information was furnished by Messrs. J. L. Anderson & Sons, of Mount Holly, N. J., and Messrs. J. J. Allen's Sons, of Philadelphia, Pa.

F 11.

IMPROVEMENT OF WOODBURY CREEK, NEW JERSEY.

No work of improvement has yet been done on this creek. The only appropriation made therefor was $5,000, on August 2, 1882. With the exception of $450.31, expended in 1882 for a survey of the creek, this amount is yet available. The proposed plan of improvement was the formation, by dredging, of a temporary channel 8 feet deep at high water and 40 feet wide, between the mouth of the creek and the village of Woodbury, a distance of about 4 miles, at an estimated cost of $15,000. From the impossibility of the permanence of a dredged channel the improvement would be of little value unless provision is made for its maintenance. While citizens directly interested have expressed themselves as willing to contribute a reasonable sum towards the maintenance of the channel, there is no guarantee that a channel once formed by the United States would be maintained by private effort. Since the formation of a dredged channel to any point short of Woodbury would be of no commercial value, and since any channel formed would not be permanent, the expenditure of available funds should be withheld, if the improvement is to be made, until the funds available will permit the formation of the proposed channel in a single season. The additional sum of $10,500 could be profitably expended during the fiscal year ending June 30, 1888.

This work is in the collection district of Philadelphia, Pa., which is also the nearest port of entry, at which the revenue collected during the year ending December 31, 1885, was $13,801,190.61.

Fort Mifflin is the nearest fort, and the Schuylkill range lights are the nearest light-houses.

Total appropriations to June 30, 1886	$5,000 00
Total expenditures to June 30, 1886	450 31

Money statement.

July 1, 1885, amount available	$4,549 69
July 1, 1886, amount available	4,549 69
Amount (estimated) required for completion of existing project	10,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	10,500 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

Arrivals and departures of vessels during the year ending December 31, 1885.

Sailing vessels	40
Barges	108
Total	148

Exports and imports.

Articles.	Exports.		Imports	
	Quantity.	Value.	Quantity.	V
Bricks			200,000	
Coal ... tons			12,500	
Clay, sand and stone ... do			6,000	
Cement, lime, and plaster ... barrels			10,150	
Fertilizers and manure ... tons			8,000	
Hay ... do			600	
Lumber ... feet			5,000,000	
Laths and shingles ... do				
Soda ash ... tons			1,500	
Wood ... cords			1,500	
Fruit and vegetables		$4,000		
Glass ... tons	7,000	500,000		
Miscellaneous merchandise		20,000		
Totals		524,000		21

The above information was furnished by Mr. C. W. Starr, of Woodbury, N. J.

F 12.

IMPROVEMENT OF MANTUA CREEK, NEW JERSEY.

No work of improvement has yet been done on this creek. The on appropriation made therefor was $3,000 on August 2, 1882, the expen ture of which was withheld by order of the Secretary of War un further appropriation should be made. The stream in its natural co dition has a low-water depth of about 9 feet for a distance of betwee 3 and 4 miles from its mouth. Above this the channel depth slowl decreases until, at Mantua, about 11 miles above the mouth, there is low-water depth of only 2 feet. The opinion of officers previously i charge was that there seems to be no necessity at present for furthe appropriations, and none are recommended.

This work is in the collection district of Philadelphia, Pa., which is also the neares port of entry, at which the revenue collected during the year ending December 31 1885, was $13,801,190.61. Fort Mifflin is the nearest fort, and Tinicum and For Mifflin Bar Cut range lights are the nearest light-houses.

Total appropriations to June 30, 1886, $3,000.

Money statement.

July 1, 1885, amount available	$3,000 00
July 1, 1886, amount available	3,000 00
Amount (estimated) required for completion of existing project	32,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

F 13.

IMPROVEMENT OF RACCOON RIVER, NEW JERSEY.

No work of improvement has yet been done on this river. The only appropriation made therefor was $3,000 on August 2, 1882. With the exception of a part expended in 1882 upon a survey of the river, this amount is yet available. The proposed plan of improvement was to make, by dredging, the navigation of the river safer and less difficult up to Swedesborough, at an estimated cost of about $18,000. By previous recommendation the appropriation of 1882 was withheld from expenditure until additional appropriations are made.

If the improvement is to be made, the sum of $16,000, in addition to what has already been appropriated, could be expended in dredging during the fiscal year ending June 30, 1888.

This work is in the collection district of Philadelphia, Pa., which is also a port of entry, at which the revenue collected during the year ending December 31, 1885, was $13,301,190.61.

Fort Mifflin is the nearest fort, and the Tinicum Island and Fort Mifflin Bar range lights the nearest light-houses.

Total appropriations to June 30, 1886	$3,000 00
Total expenditures to June 30, 1886	757 23

Money statement.

July 1, 1885, amount available	$2,242 77
July 1, 1886, amount available	2,242 77

Amount (estimated) required for completion of existing project	16,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	16,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

Arrivals and departures of vessels during the year ending December 31, 1885.

Description.	Arrivals.		Departures.	
	No.	Tons.	No.	Tons.
Steamers	4	928	4	928
Sailing vessels	16	1,920	16	1,920
Barges	8	1,200	8	1,200
Canal-boats	10	900	10	900
Total	38	4,948	38	4,948

Exports and imports.

Articles.		Exports.		Imports.	
		Quantity.	Value.	Quantity.	Value.
Lumber	feet			300,000	$4,500
Coal	tons			3,000	15,000
Stone	do			550	960
Lime	bushels			8,000	850
Bricks				100,000	1,200
Oyster-shells	bushels			20,000	600
Manure	cart loads			40,000	24,000
Flour and grain	barrels			350	1,000
Fruit and vegetables	do		$88,000		
Total			88,000		48,110

The above information was furnished by Mr. John Ford, of Swedesborough, N. J.

F 14.

IMPROVEMENT OF SALEM RIVER, NEW JERSEY.

No work has been done on Salem River during the past fiscal and no appropriation for its improvement has been made since tl August 2, 1882, of $1,500. The expenditure of this appropriatio withheld on account of the smallness of the sum and the exorb price bid for the dredging, which was 78 cents per cubic yard.

As stated in the Annual Report of the Chief of Engineers for page 814:

> At the point where the creek most nearly approached the Delaware River, vicinity of Deep Water Point, a canal was opened in 1872 for the better drain the meadows bordering the upper part of the creek and to secure a more direct outlet for the products of that region. In furtherance of this design a dam wa built across the creek below the canal, thus separating the stream into two inde ent water-courses, one having its head at the dam and discharging past Salem the cove, the other with its head of navigation at Course's Landing, 3 miles b Sharptown and 9 miles from the Delaware, into which it discharges via the c which forms the lower 2 miles of its length. The mouths of the two streams are therefore, about 10 miles apart, and the drainage of each is entirely distinct.

The canal has, to a great extent, failed to accomplish its purpos reason of its originally insufficient capacity, whereby the tidal which is about 6 feet in the Delaware, is reduced to about 1 foot at confluence of the canal and creek.

The natural mouth of the stream is obstructed by extensive sa bars, to which dredging would afford but temporary relief, unless plemented by quite expensive dike construction, extending across th shoals and into the Delaware River, while the bed of the upper par the river is obstructed with shoals or reduced, from lack of tidal fl to the dimensions of a meadow brook.

It would seem that the comprehensive improvement of Salem Ri might be deferred until the commerce of the vicinity should rende improvement more urgent than it seems to be at present. Should C gress consider it desirable to continue the improvement, the deepe channel on the upper river might be completed to Hoxie's Land which has been estimated to cost $4,000.

Salem River is in the collection district of Bridgeton, N. J., which is the ne port of entry, at which no revenue was collected during the year ending Dece 31, 1885. The nearest fort and light-houses are, respectively, Fort Delaware Finn's Point range lights.

Total appropriations to June 30, 1886	$14,50
Total expenditures to June 30, 1886	13,00

Money statement.

July 1, 1885, amount available	$1,49
July 1, 1886, amount available	1,49

COMMERCIAL STATISTICS.

Arrivals and departures of vessels during the year ending December 31, 1885.

Description.	Arrivals.		Departı	
	No.	Tons.	No.	T
Steamers	3	600	3	
Sailing vessels	12	1,200	12	
Barges	20	2,000	20	
Canal-boats	8	800	8	
Total	43	4,600	43	

Exports.

Articles.	Quantity.	Value.
Lumber .... feet..	1,000,000	$200,000
Grain .... bushels..	100,000	50,000
Coal .... tons..	5,000	25,000
Lime .... bushels..	1,000,000	100,000
Canned fruits .... cans..	500,000	100,000
Fruit .... baskets..	100,000	50,000
Vegetables .... do....	3,500,000	350,000
Agricultural implements	....	50,000
Miscellaneous merchandise	....	100,000
Total	....	1,025,000

The above information was furnished by Dr. Charles Newton, of Sharptown, N. J.

F 15.

IMPROVEMENT OF COHANSEY CREEK, NEW JERSEY.

No work has been done on Cohansey Creek during the past fiscal year, and no appropriation for its improvement has been made since that of August 2, 1882, appropriating $5,000. This amount was practically expended during the fiscal year ending June 30, 1883, in widening and deepening the channel below Broad Street Bridge at Bridgeton to a depth of 7 feet at mean low water.

At Bridgeton the creek is obstructed by the crossing of the gas and water mains, which are placed at a depth of about 4 feet below mean low water. The attention of the city authorities has been officially called to the matter, and they have had the question of lowering these pipes under consideration for several years, but no action thereon has yet been taken. The improvement of the creek above this point would be without value until the pipes are lowered to a proper depth by the municipal authorities of Bridgeton, and until this is done no appropriation is recommended.

This work is in the collection district of Bridgeton, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1885. The nearest fort and light-house are, respectively, Fort Delaware and Maurice River Light.

Total amount appropriated to June 30, 1886	$36,000
Total amount expended to June 30, 1886	36,000

Money statement.

Amount (estimated) required for completion of existing project .... Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	$5,500

F 16.

REMOVAL OF WRECKS FROM DELAWARE BAY AND RIVER.

There have been no operations during the past fiscal year under this appropriation, the removal of all wrecks having been accomplished under the general provisions for "removing sunken vessels or craft obstructing or endangering navigation."

Money statement.

July 1, 1885, amount available	$2,
July 1, 1886, amount available	2,

F 17.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDAN ING NAVIGATION.

During the past fiscal year there have been removed from the D ware River under the provisions of section 4, act of June 14, 1880, wrecks of the sloop Ann and the steam canal-boat Thomas Carroll

The sloop Ann, a wooden vessel of about 51 tons measurement, sunk in July, 1883, in 4 fathoms of water, about 600 feet west of D Water Point Range and off the lower part of New Castle, Del. vessel was a dangerous obstruction to navigation.

The steam canal-boat Thomas Carroll, a wooden vessel of about tons, was sunk in October, 1884, in about 4 fathoms of water, near intersection of the Schooner Ledge and Cherry Island Flats ran An examination showed about 21 feet of water over the highest par the wreck.

These vessels having been abandoned by their owners, proposals their removal were received under date of September 4, 1885, and contract therefor was awarded to Frank C. Somers, the lowest bid for the sum of $800 for both wrecks. The work was accomplished September 25, 1885.

An examination was made of parts of the wreck of the ship Adolph lying in the path of vessels and about 4 miles east of Cape Henlo The wreck was considered as endangering navigation. The necess notice to owners has been given and proposals for its removal invit

Abstract of proposals for removal of wrecks in the Delaware River, received and op September 4, 1885, by Lieut. Col. Henry M. Robert, Corps of Engineers.

No.	Names and addresses of bidders.	Price for removing—		
		Sloop Ann.	Steam canal-boat Thomas Carroll.	Bot wrec
*1	H. S. Wright, Philadelphia, Pa	$425	$500	......
2	Charles W. Johnston, Lewes, Del	445	540	
*3	Baltimore Wrecking Company, Baltimore, Md	450	500	
4	William E. Chapman, New York City	800	1,400	
5	Atlantic and Gulf Wrecking Company, Somers Point, N. J.	400	700	
6	Hibbard Youngs, Brooklyn, N. Y	977	1,333	
7	American Dredging Company, Philadelphia, Pa	500	900	
8	Frank C. Somers, Philadelphia, Pa	....	....	
9	Elijah D. Register, Lewes, Del	394	1,189	

*Informal.

NOTE.—On September 5, an informal proposal was received by mail from Mr. John W. Guid New York City, for removing the Ann at $2,000 and Carroll at $12,000; both wrecks, $14,000.

Contract (dated September 11, 1885) awarded to Frank C. Somers.

d States Army, members, and Mr. H. L. Marindin, United States
Survey, secretary.

re has been a number of meetings of the commission during the
nd much valuable work has been done and important conclusions
ed. As the result of careful study and investigation, on February
86, the commission submitted to the Board of Harbor Commis-
s plans for a port-warden's line on the Delaware River front,
practically fixed that line from the mouth of the Schuylkill to
sburg. A description of said line and a copy of a letter transmit-
he same to the Harbor Commissioners are appended hereto. This
as approved by the Harbor Commissioners and formally adopted
councils of the city of Philadelphia, and is now, therefore, defi-
established as the legal port-warden's line for this part of the
are River front, which cannot be changed except by State legis-

en the question of a port-warden's line from Bridesburg to the
limits of the city came under consideration of the commission, it
und that while there was a good hydrographic chart, recently
d by the Engineer officer in charge of the Delaware River im-
ments, no physical survey of this part of the river had ever been
The commission was of the opinion that it could not intelli-
act upon the very important question before it without the data
ould be furnished by such physical survey. The views of the
ission upon this subject are fully set forth in the memorandum
hed to the Board of Harbor Commissioners, a copy of which is
appended.

councils of the city of Philadelphia, upon the request of the
r Commissioners, appropriated the sum of $2,500 for the purpose
king this survey, and the work is being done by the United States
Survey, at the expense of the city, and under the immediate direc-
f Mr. H. L. Marindin, secretary of the commission. The field work
rly finished, and it is expected that the commission will be in pos-
n of a good physical chart of this part of Delaware River early

done the purpose for which it was created will have been accom viz:

To refer the Delaware River line to fixed monuments, and to plans for a port-warden's line around Smith's and Windmill and from the mouth of the Schuylkill to the lower limits of the

It is believed that the whole work will be completed by the the next fiscal year.

LETTER TO THE BOARD OF HARBOR COMMISSIONERS.

PHILADELPHIA, PA., *February* 13

SIR: Herewith we have the honor to transmit to the Harbor Commission c delphia three charts and a description of a port-warden line of the Delawa Front for the portion from the mouth of the Schuylkill River to a point Bridge street, at Bridesburg.

In deciding to recommend this line, we need hardly state that it is not suc should have drawn had we found the river in its original condition, and had quired to provide for the retention of its natural facilities for navigation. Ou cal survey discovered that the river has adjusted itself to the encroachments shores; sometimes to the injury, sometimes to the advantage of navigation, a in the main, these effects have ultimated so that the introduction of large ch the alignment of the piers at this late hour would involve uncertain conseque localities where great commercial establishments exist, without the certainty provement elsewhere. It has therefore been the study of your Advisory B make only such changes as should be necessary to preserve the net advantag community.

It will be observed that the line we recommend cuts off a considerable po the wharf of the Pennsylvania Railroad at Greenwich Point, and a small part o below Tasker Street, and it is suggested that the city should treat with these for the removal of the protruding portions of these structures, at least whene tensive repairs shall become necessary.

The line along the coal wharves above Greenwich Point has been locate not to interfere with existing structures, in the confident anticipation of the r of the middle ground, which seriously obstructs navigation in this neighborh

The portion of the line above Richmond has been located with due referenc works of channel improvement undertaken by the General Government above Island. This improvement, while it does not conform in plan and disposition o to that suggested in 1883 by your Advisory Board, promises to lead in the sam tion and inspires much hope of success.

The port-warden line for the frontage above Bridesburg and for the islands recommended as soon as the necessary surveys and studies are complete, an general report will be submitted, in which the surveys, observations, and co tions will be furnished in detail.

The description which is herewith inclosed fixes geodetically all the turnin and gives the direction and distance from point to point. It is proposed by th to refer this port-warden line to monuments to be planted at designated poin to render its location more convenient for practical purposes. Some of these ments are now in position, and as soon as the season will permit the work pushed to completion, and we request authority to file a further description same line at some date in the near future.

In conclusion, this Board desires to state that the delay in reporting a revis warden line is attributable to the following causes: The desire to secure th action of the States of New Jersey and Pennsylvania, the discovery that legisla the State authorities was necessary, and, so far as the upper part of the line cerned, the completion of the survey.

G. B. WHITE,
Captain, U. S. N., Chai
HENRY MITCHELL,
Coast and Geodetic S
HENRY M. ROBERT
Lieut. Col. Engineers, U.

The PRESIDENT OF THE HARBOR COMMISSION
For the Port of Philadelphia.

75° 09' 15.909"; thence by a straight line N. 79° 58' 28" E. 1108.15 feet to F in
53' 06.784", long. 75° 09' 01.910"; thence by a straight line N. 64° 22' 07" E.
feet to G in lat. 39° 53' 09.171", long. 75° 08' 55.451"; thence by a straight
54° 02' 27" E. 689.47 feet to H in lat. 39° 53' 13.171", long. 75° 08' 48.290";
by a straight line N. 46° 27' 55" E. 1161.27 feet to I in lat. 39° 53' 21.080",
5° 08' 37.492"; thence by a straight line N. 40° 46' 54" E. 1084.95 feet to K in
53' 29.201", long. 75° 08' 28.393"; thence by a straight line N. 35° 16' 48" E.
feet to L in lat. 39° 53' 36.278", long. 75° 08' 21.898"; thence by a straight
29° 48' 43" E. 1114.00 feet to M in lat. 39° 53' 45.831", long. 75° 08' 14.795";
by a straight line N. 21° 41' 12" E. 1399.25 feet to N. in lat. 39° 53' 58.684",
5° 08' 08.160".

next line is shown on tracing sheet No. 2.

nning at N. the line runs by a straight line N. 18° 09' 22" E. 2152.1 feet to O in
54' 18.895", long. 75° 07' 59.551"; thence by a straight line N. 9° 34' 35" E.
feet to P in lat. 39° 54' 28.392", long. 75° 07' 57.471"; thence by a straight line
2' 11" W. 1238.1 feet to Q in lat. 39° 54' 40.616", long. 75° 07' 58.176"; thence
raight line N. 10° 52' 35" W. 1003.3 feet to R, in lat. 39° 54' 50.356", long. 75°
06"; thence by a straight line N. 17° 18' 59" W. 1009.7 feet to S in lat. 39° 54'
long. 75° 08' 04.463"; thence by a straight line N. 21° 27' 34" W. to the point T,
lies at the intersection of the prolongation of the north side of Tasker street
e southerly extension of the present authorized port-warden line of 1856, from
ing point off the foot of Christian street to the point on the extension of the
ide of Dickinson street, 560 feet from the west side of Delaware avenue. Thence
he extended authorized port-warden line of 1856 to the point T', which coin-
ith the turning point on the port-warden line of 1856, 560 feet from the west
Delaware avenue, on the extension of the north side of Dickinson street.

the point T', off the foot of Dickinson street, to the turning point at the foot
street, in Petty's Island, north channel, no changes in the present authorized
rden line of 1856 are proposed by this commission.

nning at the point U, shown on the accompanying tracing sheet No. 3 (which
es on the southerly extension of the east side of Ann street, 963 feet 11¼ inches
he south side of Delaware avenue, and is one of the turning points of the
authorized port-warden line of 1856), the line runs by a straight line N. 72°
E. to V in lat. 39° 58' 41.978", long. 75° 05' 17.700"; thence by a straight line
2' 23" E. 1702.3 feet to W. in lat. 39° 58' 47.674", long. 75° 04' 57.122"; thence
raight line N. 63° 43' 01" E. 1550.0 feet to X in lat. 39° 58' 54.463", long. 75°
59"; thence by a straight line N. 53° 09' 02" E. 1099.6 feet to Y in lat. 39° 59'
, long. 75° 04' 27.965"; thence by a straight line N. 50° 13' 17" E. 1165.0 feet
lat. 39° 59' 08.347", long. 75° 04' 16.466"; thence by a straight line N. 43°
E. 814.44 feet to A' in lat. 39° 59' 14.145", long. 75° 04' 09.206"; thence by a
line N. 37° 51' 10" E. 814.83 feet to B' in lat. 39° 59' 20.506", long. 75° 04' 02.781";

sulted from the artificial structures and encroachments along the shores. T parisons also show that injuries to navigation were by no means necessary the utilization of the harbor, and that the beneficial effects fortuitously here and there might have been foreordained and extended if a proper stud ceded the locations of port-warden's lines in former years.

The laying out of a highway on the land is a matter in regard to which th passer-by may form a somewhat intelligent opinion; but when it comes to t ment of a natural water-course, even the careful and public-spirited may b by a too *superficial* view. We use the word *superficial* here in its rarely liter for it is *space* only that strikes us in looking upon the natural harbor or its c depth of the river and its passing volume being occult. A statement of t would seem too obvious to be made, but it is really one of those *too familia* that are overlooked.

The soundings and gaugings of the Advisory Commission have discovered best effects in the improvement of navigation have sometimes resulted from t pation of water spaces which excited at the outset the indignation of a jeal lic; while ill effects have often resulted from slight extensions elsewhere wl public ignored.

A physical survey is necessary to determine to what extent any proposed en ment will interrupt or turn aside the stream, and it is by gauging the volum displaced on the ebb, on the flood, and in freshets that we measure in adva *strain* upon the channel. For in alluvial bottoms the channel is the cast of th waters within; it is not the independent mold into which the river is turned is the trough hollowed out by the running water, and it alters its form and di with every change that may be induced upon the flow.

Before giving license to encroachments, the consequences must be measured a question between the individual interest and the interest of the communi the privilege to use the public domain should involve no injury which is no than counterbalanced by public good. As it is, the community has not made t of the bargain in dealing with the individual, and the little loss of advanta multiplied with the growth of trade till it is a heavy burden.

A wharf is a harbor improvement; it furnishes a better landing than natura isted, so that trade is made possible, or more convenient and profitable; but wharf is so extended as to turn the stream somewhat from its natural course, it is lengthened or caused to attack the opposite shore, or create shoals, the tage to the community is in question. Experience has shown that the occupa a harbor for commercial purposes need not impair its natural advantages for n tion; the natural banks may be walled in, often to the improvement of navi So that granting of licenses to build wharves under proper restrictions or pro is not parting with valuable privilege, but securing guarantees of improveme

Before public roads were laid out the owner of a house could venture to en on the wagon-road where few had ever passed, and where his act would pas sented; but when a busy city has sprung up about him his little act of cupidi all the effect of a great crime, for it now obstructs or retards the commerce world. The public are quick to detect the smallest encroachment upon a city it cannot be concealed, and it must be immediately resented. But the greates highways, the harbor channel leading to the sea, is out of sight and therefore out of mind. One would suppose that the community would have the main c under perpetual survey, but in most cases the interest in the channel is spas and when the rare surveys are compared the injuries to the channel can charged upon the individuals or upon special works along shore. So many and effects have accumulated in the long interval of indifference that they longer be distinguished.

The city front above Richmond has been but little utilized because of th shoal that has accumulated in the neighborhood of Five Mile Point, and whi General Government now designs to remove in part. Should the Government cessful, the water-front that the city offers above will be appreciated because bold banks and handy channel.

We have before us a map of this portion of the Delaware from Five Mile P the city limits at Poquessing Creek, executed in part by the city and in part General Government. The shore-lines and objects on the land are from surv rected by the city engineer, while the soundings were mapped and made und direction of the United States Engineers.

As we go up the Delaware from the bay the traces of tidal action lessen a physical characteristics of river flowage relatively increase. Above Bridesbur are regular "crossings" between reverse curves, and there are bars at these p *inflection*, much the same as in tideless rivers, except that more water can be over them. It would seem that the tides are beneficial, since they prevent th pletion of the obstructions at the nodes of the bends.

ia.
n near the head of Petty's Island 4-fathoms may be carried up the channel at
ater to a point nearly abreast of Pennypack Creek, or about 5½ miles. Here is
aring" with not less than 3 fathoms upon it, and beyond the 4-fathom channel
s and continues very nearly to the city limits.

a view to the preservation of all these natural advantages of both channel-
d landing, we should accommodate all artificial structures on the foreshores to
w of the water, so as to introduce no material change among the forces at work.
forces are ebb and flood tidal currents (during the greater portion of the year)
ver currents of varying velocity and volume during the season of freshets.
we observe in the form of the channels and banks is really an *adjustment* in
features favorable to our wants are, in some sense, fortuitous, not usually pres
so great degree.

proposed to gauge the currents and determine their *resultants* reflected in the
ent to which we have just referred. At about 40 cross-sections we should de-
e the transverse curves of velocities, so as to learn in what manner the volume
during the flood, during the ebb, and during the freshets; we then should
upon the chart lines of equal velocities for ebb and for flood (isodynamic lines),
imately lines of equal *resultant* power or *equal scour;* and when we came to the
g of a port-warden line we should adjust it to these natural lines, so as to se-
l that can be safely used; it should be the line between use and abuse.

oved by the Board Advisory to the Philadelphia Harbor Commissioners, and
ded to the Philadelphia Harbor Commissioners as the expression of the views
Board on this subject.

G. B. WHITE,
Captain, U. S. Navy,
Chairman Board Advisory to Philadelphia Harbor Commissioners.

UARY 25, 1886.

OVEMENT OF HARBORS AND RIVERS IN THE STATES OF DELAWARE D MARYLAND—IMPROVEMENT OF MAURICE RIVER, NEW JERSEY.

RT OF MR. WILLIAM F. SMITH, UNITED STATES AGENT, IN CHARGE, THE FISCAL YEAR ENDING JUNE 30, 1886, *WITH OTHER DOCU-NTS RELATING TO THE WORKS.*

IMPROVEMENTS.

urice River, New Jersey.
ilmington Harbor, Delaware.
-harbor at New Castle, Delaware.
ck Creek, Delaware.
int Jones River, Delaware.
spillion Creek, Delaware.
oadkiln River, Delaware.
oad Creek, Delaware, from its mouth to Laurel.
lian River, Delaware.
squehanna River above and below Havre de Grace, Maryland.
11. Chester River at Kent Island Narrows, Maryland.
12. Chester River from Spry's Landing to Crumpton, Maryland.
13. Corsica Creek, Maryland.
14. Choptank River, Maryland.
15. Wicomico River, Maryland.
16. Upper Thoroughfare, between Deil's Island and the mainland, Maryland.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., July 29, 1886.

NERAL: I have the honor to submit herewith the Annual Report of orks of river and harbor improvement in my charge for the fiscal nding June 30, 1885.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

g. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

of last fiscal year. The contract was completed in April, 1886,
following improvement is the result of the work :

A channel was dredged through French's Bar, 4 miles belc
ville, 200 feet in length, 100 feet wide ; from a point 2.14 mile
Millville a channel was dredged 100 feet wide to a point called Pe
ing (including a cut through the point of land at Silver Run, tl
of way having been given the United States free of cost); fr
Landing to the bridge at Millville the channel was dredged 50
width, except just below the bridge, where the width was incre
75 feet for a distance of 300 feet. This increased width was to c
point. Above the bridge for a distance of 400 feet a channel was d
100 feet in width, and from this point to Wood's Mills, the h
navigation, a distance of 2,600 feet the channel was reduced a
50 feet in width. A depth of from 5 to 6 feet was made over the
dredged channel.

The excess in depth over what was required by the contract (
was necessary to float the contractor's plant, and was made at th
pense. The total amount of material removed in accordance wi
terms of the contract, is 110,015 cubic yards, measured in place,
exhausted the appropriation.

This improvement has been beneficial already to the commerce
river, which is extensive, by enabling a larger class of vessels to
Millville without interruption by low water.

It is proposed to apply the appropriation asked for the fiscal
ending June 30, 1888, to continuing the work of improvement f
foot low-water navigation by dredging wherever a less depth of
is found in the river.

This work is in the collection district of Bridgeton, N. J., which is also the
port of entry, and at which no revenue was collected during this fiscal year.

AMOUNTS APPROPRIATED.

By act passed August 2, 1882	
By act approved July 5, 1884	
Total	

Money statement.

July 1, 1885, amount available	$18,
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	18,
July 1, 1886, amount available	
Amount appropriated by act approved August 5, 1886	5,
Amount available for fiscal year ending June 30, 1887	5,
Amount (estimated) required for completion of existing project	87,
Amount that can be profitably expended in fiscal year ending June 30, 1888	35,
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

LETTER OF COLLECTOR OF CUSTOMS AT BRIDGETON, NEW JERSEY.

CUSTOM-HOUSE, BRIDGETON, N. J.
Collector's Office, June 29,

In reply to yours of the 21st instant, I have to report that there is no reven
lected in this district. We have no imports ; the only money we ever collect

marine-hospital dues (and that tax was abolished two years ago), and occasionally some small sums in the way of steamboat-inspection fees; the last mentioned amounted, during the year now about closed, to $64.30.

Very respectfully,

J. H. ELMER,
Collector Customs.

WM. F. SMITH.

G 2.

IMPROVEMENT OF WILMINGTON HARBOR, DELAWARE.

The work of improvement of this harbor has been limited during the present fiscal year, owing to the inadequate amount of money available to do the next most important part of the project, *i. e.*, to construct an extension to the jetty at the entrance. During the year the old sunken crib off Lobdell's Canal was removed, and also the two light-house wharves, near the entrance of the harbor, were pulled down and the material put on the embankment, as agreed with the Light-House Establishment.

These obstructions had a tendency to increase the difficulties of navigation by choking and jamming the floating ice during the spring months, and also checked the velocity of the tides and caused shoals at these places.

A channel was dredged through the draw at Market Street Bridge to a depth of 15 feet, at mean low water, and a width of 80 feet. The amount of material removed from this locality is 3,650 cubic yards, measured in place, and it consisted of gravel, sand, and blue clay, 12 bowlders, varying in size from one half to 2½ cubic yards, and 32 piles.

The raising of the jetty seems to have done away with the shoaling from a point about midway of the jetty out to the Delaware River, and the depth of channel dredged in 1884, connecting the 15-foot curve in the Delaware with the 15-foot curve inside the harbor, had been maintained at the last examination. The present angle of collision of the currents of the Delaware and Christiana will, however, always produce a bar at the mouth, and this can only be obviated by the carrying out of the approved project for the extension of the jetty.

The amount asked for the fiscal year ending June 30, 1888, is $75,000, and if appropriated, together with the balance available, will be applied to the extension of the jetty and dredging the channel to a depth of 15 feet, to the Pulp Works.

Wilmington is a port of entry, and in the collection district of Delaware. The amount of revenue collected for the last fiscal year is $16,011.97.

AMOUNTS APPROPRIATED.

By act approved July 14, 1836	$15,000
By act approved March 3, 1837	8,000
By act approved July 7, 1838	9,356
By act approved July 11, 1870	15,000
By act approved June 10, 1872	10,000
By act approved March 3, 1873	6,000
By act approved June 23, 1874	6,000
By act approved March 3, 1875	10,000
By act approved August 14, 1876	16,000
By act approved June 18, 1878	7,000
By act approved March 3, 1879	3,500
By act approved June 14, 1880	10,000
By act approved March 3, 1881	50,000
By act passed August 2, 1882	50,000
By act approved July 5, 1884	25,000

Money statement.

July 1, 1885, amount available	$17
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	3,
July 1, 1886, amount available	13,
Amount appropriated by act approved August 5, 1886	18,
Amount available for fiscal year ending June 30, 1887	31,
Amount (estimated) required for completion of existing project	147,
Amount that can be profitably expended in fiscal year ending June 30, 1888	75,

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, WILMINGTON, DEL.,
Collector's Office, July 27, 1

SIR: In response to your request I have to inform you that the total collecti this district during the fiscal year ending June 30, 1886, amount to $16,011.97. number of vessels permanently documented in the district is as stated below, vi

Class.	Number.	Gross tonnage.	Net
Sail vessels	147	12,[illegible].34	12,
Steam vessels	28	4,[illegible].30	3,
	175	16,754.64	15,

Very respectfully,

HENRY F. PICKELS,
Collect

General WM. F. SMITH.

G 3.

ICE-HARBOR AT NEW CASTLE, DELAWARE.

Nothing was done on the improvement of this harbor during past fiscal year for want of funds. The harbor is formed by piers (mond shaped) of wooden cribs, filled to low-water mark with stone capped with about 6 feet of dressed stone.

These piers are much in need of repairs, and the area of the har should be increased by dredging. A full report of the condition of piers and an estimated cost of the needed improvement will be foun the Annual Report of the Chief of Engineers for 1885, Part I, pages and 875.

The harbor at New Castle is of great importance to the general c merce on the Delaware River, and its benefit to the city itself only direct. A large number of vessels seek refuge there during the sea of running ice. None of them belong to the city of New Castle, an thus becomes of interest to several States.

The ice-harbor of New Castle is in the collection district of Delaware, and mington is the nearest port of entry. The amount of revenue collected there du the past fiscal year is $16,011.97.

AMOUNTS APPROPRIATED.

By act approved May 20, 1826	$25,000 00
By act approved March 2, 1829	00
By act approved July 2, 1836	
By act approved March 3, 1837	
By act approved July 7, 1838	11
By act approved August 30, 1852	15,000 0
By act approved July 15, 1870	2,500
By act approved June 10, 1872	27,000
By act approved March 3, 1873	20
By act approved June 27, 1874	1
By act approved March 3, 1875	2
By act approved August 14, 1876	1
By act approved June 18, 1878	10
By act approved March 3, 1879	5
By act approved June 14, 1880	3
By act approved March 3, 1881	20,000 00
By act approved July 5, 1884	2,000 00

Of the above appropriations $18,285.05 has been turned into the surplus fund of the Treasury.

Money statement.

Amount appropriated by act approved August 5, 1886	$5,000 00
Amount (estimated) required for completion of existing project	15,600 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	15,600 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

G 4.

IMPROVEMENT OF DUCK CREEK, DELAWARE.

Nothing has been done during the fiscal year ending June 30, 1886, for want of funds, and I am unable for the same reason to state the condition of the work at that time. It is proposed to apply the appropriation asked for the fiscal year ending June 30, 1888, to removing the shoals in the bed of the stream from the mouth of the river to the town of Smyrna. The commerce on the creek is not deemed sufficient to justify the expenditure necessary for the improvement of the mouth.

Duck Creek is in the collection district of Delaware. Wilmington is the nearest port of entry, and the revenue collected there for the last fiscal year amounted to $16,011.97.

AMOUNTS APPROPRIATED.

By act approved June 14, 1880	$5,000 00
By act approved March 3, 1881	3,000 00
By act passed August 2, 1882	2,000 00
Total	10,000 00

Money statement.

Amount (estimated) required for completion of existing project	$12,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	12,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

OFFICE PHILADELPHIA AND SMYRNA TRANSPORTATION COMPANY,
Smyrna, Del., July 1, 18

DEAR SIR: In accordance with request contained in your favor of 21st ultimo herewith submit the following estimate of the business and shipping interests of D Creek, Delaware:

Articles.		Quantity.	Valu
Coal	tons	7,000	42
Iron and steel	do	600	20
Hay, salt and fresh	do	700	9,
Fertilizers	do	20,000	500,
Lumber	feet	1,500,000	75,
Grain	bushels	400,000	350,
Lime	do	150,000	20,
Fruit—peaches, &c	baskets	750,000	375,
Peach baskets		500,000	50,
Evaporated and canned goods		.....	250,
Live stock	head	7,000	175,
Agricultural implements			100,
Merchandise (about)			900,
Total			2,866,

In addition to above there is considerable commerce, consisting of such articl as truck, eggs, fish, poultry, oysters, &c. Besides, one iron propeller steamboat, draw ing 6¼ feet water, say three to five schooners, 30 to 80 tons' capacity, drawing 5 to 6 feet water, several sloops and fishing vessels, also three to five barges, capacities, 10 to 250 tons, draught about 6¼ feet; these comprise the fleet navigating this stream The above estimates are made as nearly as possible from the business coming unde our observation, and of course is subject to the increase of irregular trades.

Respectfully submitting the above, we are, very truly,

THE PHILADELPHIA AND SMYRNA TRANSPORTATION COMPANY.

General WM. F. SMITH,
United States Agent.

G 5.

IMPROVEMENT OF SAINT JONES RIVER, DELAWARE.

As reported last year, a contract was made in December, 1884, for the improvement of this river by straightening and deepening the channel to 6 feet at mean low water wherever a less depth was found, and to a width of 40 feet; also to make a cut-off at Cherry Tree Bend of the same width and depth, and widen another near Dover. The work was to commence at the mouth and continue up-stream as far as the available money would permit, but the dredge having been constructed at Dover it was necessary to dredge a distance of 941 feet down-stream before the natural depth of water sufficient to float the dredge was reached.

The channel was dredged 6 feet deep at low water and 40 feet wide, and a turning-basin 180 feet in length and 80 feet wide was also made at Dover in accordance with the project. Commencing at the second shoal inside the mouth of the river and working up-stream, a 6-foot low-water channel 40 feet in width was dredged at the following shoals:

Locality.	Length.	Locality.	Length.
	Feet.		*Feet.*
Warren's Landing Shoal	825	Phosphate Factory Shoal	1,885
Jack's Point Shoal	340	James Island Shoal	1,000
Logan's Landing Shoal	600	Babbitt's Fishery Shoal	766
Hevern's Landing Shoal	550	Wharton's Fishery Shoal	750
Red Granary Shoal	1,500	Lebanon Shoal	330
White Store Landing Shoal	2,000	Lebanon Reach and Mud Hole Point	2,270

At Cypress Point the channel was widened 33 feet for a length of 345 feet, depth 6 feet; and at Cherry Tree Bend a cut-off was made 1,020 feet long, 40 feet in width, and 6 feet deep at mean low water. The right of way through land for this cut-off was given to the United States free of cost. The benefit to navigation by this cut-off is a saving in distance of about 4,000 feet, besides avoiding the abrupt bends in the river at this locality.

After the above-named work had been done the dredge was removed again down the river, and work commenced at Broad Reach Shoal, the first shoal inside the mouth. At this shoal a channel was dredged 2,270 feet to a depth of 6 feet at mean low water and a width of 40 feet.

The total distance dredged during the year is 17,072 feet, and the total amount of material removed is 54,128 cubic yards, measured in place, which was deposited on the banks of the river 50 feet from edge of channel.

The balance of funds available June 30, 1886, will be applied to the completion of the channel through Broad Reach Shoal and to continuing the channel above Lebanon.

Work under this contract will probably be completed by the end of July. It is proposed to apply the appropriation asked for the fiscal year ending June 30, 1888, to the continuance of the improvement of the river for a 6-foot low-water navigation to Dover.

Dover is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected for the last fiscal year is $16,011.97.

AMOUNTS APPROPRIATED.

By act approved March 3, 1881	$5,000
By act approved July 5, 1884	10,000
Total	15,000

Money statement.

July 1, 1885, amount available		$14,162 11
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$11,546 08	
July 1, 1886, outstanding liabilities	1,122 44	
		12,668 52
July 1, 1886, amount available		1,493 59
Amount appropriated by act approved August 5, 1886		10,000 00
Amount available for fiscal year ending June 30, 1887		11,493 59

Amount (estimated) required for completion of existing project	10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	10,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

G 6.

IMPROVEMENT OF MISSPILLION CREEK, DELAWARE.

No work has been done on the improvement of this stream during the fiscal year ending June 30, 1886, for want of funds, and the condition of the work at that time is not known for the same reason.

It is estimated that $3,500 will complete the project for the improvement of the creek, by removing the remainder of the shoals between Milford and the mouth of the creek, which will give a 6-foot low-water navigation for the entire distance. This improvement will be of g benefit to navigation and commerce interested by lessening the tim quired to get up and down the stream.

If the bar at the mouth is to be improved it is estimated that $55 additional will be required, but it is doubtful if the commerce on creek will justify this expenditure.

Mispillion Creek is in the collection district of Delaware. Wilmington is the n est port of entry, at which the revenue collected for the last fiscal year, was $16,011

AMOUNTS APPROPRIATED.

By act approved March 3, 1879	$3,
By act approved June 14, 1880	4,
By act approved March 3, 1881	3,
By act passed August 2, 1882	3,

Money statement.

Amount (estimated) required for completion of existing project	$58,500
Amount that can be profitably expended in fiscal year ending June 30, 1888	3,500
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

G 7.

IMPROVEMENT OF BROADKILN RIVER, DELAWARE.

The history of this improvement is given in the Annual Report of th Chief of Engineers for 1881, beginning on page 780.

A project adopted for the improvement of this river with the fund available at the end of last fiscal year, was to dredge a channel 40 fee wide and 6 feet deep at mean low water, wherever a less depth wa found between the mouth of the river and Milton, Del., and to cut of certain sharp bends interfering with navigation.

After due advertisement a contract was made with the America Dredging Company of Philadelphia to execute the work. The dredging was commenced promptly and continued till December, 1885, when the project was completed and the funds exhausted.

The total distance dredged was 24,225 feet, and the total amount of material removed was 92,737 cubic yards. A channel was made from the junction of Lewes Creek to Milton, 6 feet in depth at mean low water, with a width in no place less than 40 feet; six bends in the river were widened to 60 and 70 feet. The mean rise of tide at Milton, before the improvement commenced, was 1.8 feet; it is now 3 feet. I am also informed by captains of vessels that the water over the bar at the mouth has increased fully 1 foot since the improvement has been made. Vessels are now able to go from Milton to the mouth of the river at any stage of the tide, and not more than one half day is required to make the trip; before the improvement it took two and three days. This has been a great benefit to navigation, and an increased trade on the river will eventually follow.

Milton, at the head of navigation, is a thriving town, and the shipping point for a large and fertile section of country.

The work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected for the last fiscal year is $16,011.97.

AMOUNTS APPROPRIATED.

By act approved March 3, 1873	$10,000
By act approved June 14, 1880	5,000
By act approved March 3, 1881	5,000
By act passed August 2, 1882	5,000
Total	25,000

Money statement.

July 1, 1885, amount available	$13,254 08
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	13,254 08
Amount (estimated) required for completion of existing project	31,500 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

Abstract of proposals received and opened at 12, noon, of July 16, 1885, for dredging in Broadkiln River, Delaware, by Mr. William F. Smith, United States Agent.

No.	Names and addresses.	Time.		Price per cubic yard (place measurement).	Price per cubic yard (scow measurement).
		Commence.	Complete.		
				Cents.	*Cents.*
[1]1	American Dredging Company, Philadelphia, Pa.	Aug. 1, 1885	Oct. 1, 1885	12	....
2	National Dredging Company, Wilmington, Del.	....	Nov. 1, 1885	14	....
3	Frank C. Somers, Philadelphia, Pa	Aug. 1, 1885	Dec. 31, 1885	18¼	13¾
4	George E. Ward, Edenton, N. C	Oct. 1, 1885	Apr. 30, 1886	12¾	15
[2]5	Frank Pidgeon, New York, N. Y	....	....	17 3/10	14½
[3]6	John Satterlee, Englewood, N. J	Not stated	Not stated	....	....

[1] Measured in bucket; 7 cents per cubic yard.
[2] Commence and finish within the fiscal year.
[3] Nineteen cents per cubic yard. Mode of measurement not stated.

G 8.

IMPROVEMENT OF BROAD CREEK, FROM ITS MOUTH TO LAUREL, DELAWARE.

The history of this improvement and of the existing project is given in the Annual Report of the Chief of Engineers for 1883.

Nothing was done on this improvement during the fiscal year ending June 30, 1886, for want of funds, and for the same reason the condition of the work at that date is not known. The amount asked for the fiscal year ending June 30, 1888, will be applied to the continuance of the project for a 6-foot low-water navigation to the town of Laurel, with a width of channel of 50 feet, and protecting it with dikes.

Broad Creek is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected for the fiscal year ending June 30, 1886, is $16,011.97.

AMOUNTS APPROPRIATED.

By act approved June 14, 1880	$5,000
By act approved March 3, 1881	10,000
By act passed August 2, 1882	5,000
Total	20,000

Money statement.

Amount (estimated) required for completion of existing project........	$32,0
Amount that can be profitably expended in fiscal year ending June 30, 1888	32,0
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

LAUREL, DEL., *June* 29, 18

In reply to the within communication, we have only to say that the commerc terested in the improvement of Broad Creek remains substantially the same found in your report of 1885, on page 881, Appendix H, with the exception of th dition of a steam freight-boat of a carrying capacity of 200 tons, trading from L to Baltimore and Philadelphia. Hoping the above, with the statistics embodie your above-mentioned report of 1885, may be satisfactory,

I am, most respectfully,

J. TURPIN MOOR

General WM. F. SMITH.

G 9.

IMPROVEMENT OF INDIAN RIVER, DELAWARE.

Nothing done on this improvement during the fiscal year ending Ju 30, 1886, for want of money, and the condition of the work at that da is not known for the same reason.

Indian River is in the collection district of Delaware. The nearest port of ent is Wilmington, at which the revenue collected during the last fiscal year amount to $16,011.97.

AMOUNT APPROPRIATED.

By act passed August 2, 1882	$10,0

Money statement.

Amount (estimated) required for completion of existing project........	$50,000 0
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

G 10.

IMPROVEMENT OF THE CHANNEL OF THE SUSQUEHANNA RIVER ABOVE AND BELOW HAVRE DE GRACE, MARYLAND.

The river and harbor act of July 5, 1884, appropriating $20,000 for this improvement, required "$5,000 shall be expended for the completion of the channel to Fishing Battery light-house, and for repairing, strengthening, and extending the piers and breakwaters." This work was done in the fall of 1884, and a report of which is given in the Annual Report of the Chief of Engineers for 1885. The balance of the appropriation was applied to dredging, by contract made with the Baltimore Dredging Company after due advertisement. Only a small amount of work under this contract had been done at the close of last fiscal year, as the commencement was delayed so as not to interfere with the shad-fishing interest.

contract required a channel to be dredged through the two shoals
the railroad bridge at Havre de Grace 100 feet wide and 12 feet
t mean low water, and the dredging off of the shoal at Watson's
to a depth of 8 feet at mean low water, as far as the available
would permit.

mencing at the shoal just above the light-house at Fishing Bat-
channel was dredged 2,225 feet in length, 12 feet deep, and 100
de. The other shoal below the bridge disappeared, although it
in the fall of 1884, when an examination was made of the chan-
he shoal near Watson's Island was dredged back from its east-
e a distance of 200 feet, in length about 3,700 feet and to a depth
t at mean low water. Work was suspended in December, 1885,
o the near exhaustion of the funds. The total amount of mate-
ıoved under this contract was 63,433 cubic yards measured in

al width of 400 feet has been cut off the shoal near Watson's
and the improvement has been of great benefit in lessening the
the ice-gorges, so damaging to property.

nuing the estimate of last year, under the alternative seemingly
l by Congress, the amount that can be profitably expended dur-
fiscal year ending June 30, 1888, is $20,000, and, if appropriated,
applied to maintaining the 15-foot navigation below Havre de
and the balance applied to continuing the work of cutting off
al at Watson's Island, to diminish the tendency of the ice to
The cutting off this shoal should continue until ice-gorges have
lieved.

hanna River is in the collection district of Baltimore. Baltimore is the
port of entry, at which the amount of revenue collected for the last fiscal year
—.

AMOUNTS APPROPRIATED.

pproved August 30, 1852	$10,000
pproved June 23, 1866	26,400
approved July 11, 1870	12,000
pproved June 14, 1880	28,000
approved March 3, 1881	15,000
passed August 2, 1882	25,000
approved July 5, 1884	20,000
otal	136,400

Money statement.

1885, amount available	$11,643 87
1886, amount expended during fiscal year, exclusive of lities outstanding July 1, 1885	11,224 80
, 1886, amount available	419 07
ıt appropriated by act approved August 5, 1886	6,000 00
ıt available for fiscal year ending June 30, 1887	6,419 07
unt (estimated) required for annual dredging	20,000 00
unt that can be profitably expended in fiscal year ending June 30, 1888	20,000 00

mitted in compliance with requirements of section 2 of river and
arbor acts of 1866 and 1867.

LETTER OF COLLECTOR OF CUSTOMS AT BALTIMORE, MARYLAND.

CUSTOM-HOUSE, BALTIMORE, MD.,
Collector's Office, July 28, 1886.

: In reply to your request of the 23d ultimo, to be furnished with statistics of
everal tributaries of the Chesapeake Bay, with a view of embodying the same

in your annual report to Congress, I have to say that I have been unable obtain the information you desire from some of the points named. Should re received later, I will forward them to you.

From the Susquehanna River near Havre de Grace I have received no reply.

* * * * * * *

I am, very respectfully,

James B. Groome,
Coll

General Wm. F. Smith,
U. S. Agent.

G 11.

IMPROVEMENT OF CHESTER RIVER, AT KENT ISLAND NARROWS, M LAND.

Nothing done at this locality since 1877.

Chester River is in the collection district of Baltimore, which is also the neares of entry, at which the revenue collected for the last fiscal year amounted to $—

AMOUNTS APPROPRIATED.

By act approved March 3, 1873	$1
By act approved June 23, 1874	
By act approved August 14, 1876	
By act approved June 18, 1878	
	$
Amount expended	$
Balance	

Money statement.

July 1, 1885, amount available	$2,
July 1, 1886, amount available	2,

G 12.

IMPROVEMENT OF CHESTER RIVER, FROM SPRY'S LANDING TO CR TON, MARYLAND.

Nothing done at this locality since the completion of the ori project in July, 1883.

A history of the work is given in the Annual Report of the Chi Engineers for 1884, page 893; and for the benefits derived from th provement made see commercial statistics given below.

AMOUNTS APPROPRIATED.

By act approved March 13, 1881	$
By act passed August 2, 1882	
Total	1

COMMERCIAL STATISTICS.

Furnished through the courtesy of Hon. James B. Groome, collector customs, Baltimore

From Chester River, Capt. W. D. Burchinal, after referring to his letter of last says:

"The advantages derived from the appropriations already made in deepenin

G 13.

IMPROVEMENT OF CORSICA CREEK, MARYLAND.

he work on this improvement was suspended in May, 1885, on ac-
ıt of the near exhaustion of the appropriation, and nothing has been
since for want of funds.

he estimated amount necessary for completion of the improve-
t in accordance with the adopted project is $20,000. That amount
sked for the fiscal year ending June 30, 1888, and, if appropri-
l, will be applied to extending the channel to the county wharf,
lging a turning-basin, and increasing the width of the channel its
re length from 80 to 100 feet, as originally recommended.

he commerce of this locality is very large, and the steamers and
els navigating the stream require a channel of 100 feet in width.

rsica Creek is in the collection district of Baltimore. Baltimore is the nearest
of entry, at which the amount of revenue collected for the last fiscal year is
—.

AMOUNTS APPROPRIATED.

ct passed August 2, 1882	$5,000
ct approved July 5, 1884	5,000
Total	10,000

Money statement.

1, 1885, amount available	$308 86
1, 1886, amount available	308 86
unt appropriated by act approved August 5, 1886	10,000 00
unt available for fiscal year ending June 30, 1887	10,308 86
nount (estimated) required for completion of existing project	10,000 00
nount that can be profitably expended in fiscal year ending June 30, 1888	10,000 00

bmitted in compliance with requirements of section 2 of river and
harbor acts of 1866 and 1867.

coal, 800,000 feet of lumber, 500,000 shingles, 1,000,000 laths, 2,500 tons of timber, 500,000 bricks, 50,000 bushels of lime, 2,000 sheep, cattle, and mule oysters, &c., in large quantities; large trade in poultry, bacon, flour, &c., 100,000 bushels of shells, 800 sacks of salt, and 100,000 boxes of peaches.

"Four schooners and 2 steamboats trade regularly between Centreville an more, with several other steamers during the peach season, and various other with lime, shingles, lumber, coal, &c.

"At Centreville Landing there are granaries with storage capacity for over bushels of grain, in addition to storage capacity for fertilizers, salt, provisio A phosphate factory, a cannery, and a fruit drier are also located at that point landing has a wharf front of over 500 yards in length. In addition to the wha Centreville Landing there are on Corsica River 8 others. The population of th is about 1,600 and of the landing about 200.

"Total amount of the business of Centreville and the landing is estima $1,100,000.

"Centreville is the terminus of the Queen Anne's and Kent Railroad, with tw senger and one freight trains daily connecting with northern-bound trains.

"Over this road a heavy business is done in grain, lime, coal, lumber, and g merchandise.

"Corsica River is now navigable for vessels and steamers of light draught.

"If the channel is deepened and widened sufficiently to allow suitable pass steamers to reach Centreville Landing, a large travel by water to and from Balt will be secured. Centreville is in the Baltimore collection district, the nearest house being Love Point, at the mouth of Chester River."

LETTER OF MR. JOHN H. OZMON.

CENTREVILLE, *June* 29, 18

DEAR SIR: In reply to yours of the 21st instant, I would say what is shipped t from Corsica River (formerly Corsica Creek) is about 200,000 bushels of wheat, 15 bushels of corn, 50,000 bushels of rye and oats, 300,000 crates or baskets of fruit tons of iron, about $500,000 worth of merchandise, 3,000 tons of coal, 800,000 shin 1,000,000 feet of lumber, 150,000 feet of square lumber, 1,000,000 laths, 440,000 br 3,000 barrels of flour, 60,000 bushels of lime for agricultural purposes, 1,500 bu of lime for building purposes, 60,000 bushels of oyster-shells, 1,000 barrels of 1,000 sacks of salt, 2,500 tons of phosphate, several vessel loads of quarry stone sides large quantities of horses, cattle, sheep, calves, Irish and sweet potatoes, bage, &c.

There are four schooners that ply between this place and Baltimore regular capacity 4,000 bushels each. Two steamboats run tri-weekly between this lan and Baltimore, and weekly we have larger and smaller crafts stopping here la various articles of freight. We consider that the deepening of the channel of Co Creek of vast importance, as we are enabled now to make three trips in the time it formerly took us to make two; besides, now it permits vessels and steam heavy draught to arrive and depart from our landings with dispatch. We thi Congress were to make an additional appropriation, enough, say, to widen our cha and deepen further up the creek, our trade would be largely enhanced.

JOHN H. OZM

General WM. F. SMITH.

G 14.

IMPROVEMENT OF CHOPTANK RIVER BETWEEN DENTON AND GRE BOROUGH, MARYLAND.

The work on this improvement was suspended in May, 1885, o count of the near exhaustion of the appropriation. Nothing has done since for want of funds.

The result of the work on this improvement has been to give a c nel 6 feet deep at mean low water to Case's Wharf, at Greensboro and through the shoal opposite Case's a depth of 5 feet. The widt the channel varies from 47 feet to 75 feet. It is proposed to apply appropriation asked for the fiscal year ending June 30, 1888, in carr the original project to give a channel 8 feet deep at mean low r and 75 feet in width by deepening and widening the channels dy dredged through the shoals between the towns of Denton and nsborough.

ptank River is in the collection district of the Eastern district of Maryland. nore is the nearest port of entry, and the amount of revenue collected there for st fiscal year is $ ——.

AMOUNTS APPROPRIATED.

approved June 14, 1880	$5,000
approved March 3, 1881	5,000
passed August 2, 1882	5,000
approved July 5, 1884	5,000

Money statement.

. 1885, amount available	$109 28
, 1886, amount available	109 28
nt appropriated by act approved August 5, 1886	10,000 00
nt available for fiscal year ending June 30, 1887	10,109 28
ount (estimated) required for completion of existing project	47,000 00
ount that can be profitably expended in fiscal year ending June 30,1888	47,000 00

mitted in compliance with requirements of section 2 of river and arbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

Articles.	Quantity.	Articles.	Quantity.
bushels..	300,000	Coal .... tons..	1,000
nates .... tons..	1,500	Merchandise	$200,000
	300,000	Canned goods .... cases..	800,000
r. .... feet..	1,000,000	Oyster shells .... bushels..	500,000
bushels..	25,000	Fruit .... baskets..	75,000

LETTER OF MR. WILLIAM MASSEY.

ar Sir: I have consulted several of the leading business men and obtained their , and above you will find the estimate of the amount of business of this section. fruit business will increase very much in the next few years, and, Baltimore one of the largest canning cities in the country, the bulk will be shipped by when the river is in a condition to let steamers up to this place. At present are 4 schooners of about 100 tons and 2 large steamers that come within 8 miles.

Respectfully,

Wm. Massey.

eral Wm. F. Smith.

G 15.

ROVEMENT OF WICOMICO RIVER FROM ITS MOUTH TO SALISBURY, MARYLAND.

he work remaining to be done at the close of the fiscal year 1885 omplete the project for straightening and widening the 7-foot chan- between Salisbury and the old steamboat wharf below, a distance bout 2 miles, was 2,217 feet. This was done in July, 1885, under the tract with P. Sanford Ross. The channel between the points named been widened and straightened by cutting off the convex side of

the bends to a width varying from 90 to 145 feet, maintaining th
of 7 feet at mean low water. This work was done with the ap
tion of July 5, 1884, of $10,000. The improvement has been c
benefit to navigation. A larger class of boats run on the river,
trade has greatly increased.

Wicomico River is in the collection district of the Eastern district, M
Crisfield is the nearest port of entry, at which the amount of revenue colle
ing the last fiscal year is $ ——.

AMOUNTS APPROPRIATED.

By act approved June 10, 1872..
By act approved March 3, 1873..
By act approved June 23, 1874..
By act approved March 3, 1875..
By act approved August 14, 1876......................................
By act approved June 18, 1878..
By act approved March 3, 1879..
By act approved June 14, 1880..
By act approved March 3, 1881..
By act approved July 5, 1884...

Money statement.

July 1, 1885, amount available.. $
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885..

July 1, 1886, amount available..

G.16.

IMPROVEMENT OF UPPER THOROUGHFARE BETWEEN DEIL'S AND THE MAINLAND, MARYLAND.

Nothing has been done at this locality during the year endin
30, 1886, the money available being inadequate to commence ope

This improvement is in the collection district of Eastern district, Marylan
field is the nearest port of entry. The amount of revenue collected there fo
fiscal year is $ ——.

AMOUNT APPROPRIATED.

By act passed August 2, 1882..

Money statement.

July 1, 1885, amount available.. $
July 1, 1886, amount available..

Amount (estimated) required for completion of existing project........ 1
Amount that can be profitably expended in fiscal year ending June 30, 1888 1
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

[Furnished through the courtesy of Hon. James B. Groome, collector customs, Baltir

From Crisfield, Upper Thoroughfare, and Deil's Island the collector of cu
Crisfield, Mr. Hance Lawson, writes as follows: No material change in the c
and trade of the above-mentioned localities has occurred since my last report

wer to your inquiries will be based on that report, with such changes as have
ought under my notice.
eld, on the Annamessex River, is the port of entry of the district of Eastern
nd, the terminus of the Crisfield branch of the New York, Philadelphia and
Railroad, and the principal landing place of the Eastern Shore Steamboat
y, running a daily line of steamers from Baltimore to the Eastern Shore of
d and Virginia.
umber of vessels enrolled and licensed at this port is 888, of which number
owned in Somerset County (in which Crisfield is situated), 230 are owned in
ter, 65 in Wicomico County, and 13 in Worcester County. The commerce of
is exclusively in the coasting trade, and the revenue derived therefrom is
mounting during the year past, ending May 31, to $1,505.86. The trade of the
Crisfield includes oyster-packing in its various forms, fish, ship-building,
ture of fish scraps and fertilizers, general merchandise, lumber, coal, wood, &c.
ster-packing industry is carried on by 12 establishments, giving employment
00 hands, and 250 vessels, owned in and around the immediate neighborhood,
ng 1,500 men, and with an invested capital of $450,000.
00,000 bushels of oysters were landed at the port during the past year, valued
000. There are 2 ship-yards and marine railways, 1 factory for the manu-
f fish-scrap and fertilizers, and 1 machine-shop, and 70 general stores, doing
ss of $475,000 annually. I would name as the principle articles of trade:

Articles.	Quantity.	Value.
tons..	3, 500	$17, 500
cords..	1, 500	6, 000
tons..	600	24, 000
feet..	1, 500, 000	180, 000

parativety new business, the catching and shipping of crabs, is assuming large
ons. It gives employment during the summer months to over 500 men and
ith nearly the same number of small boats, and amounts in value to about
per year.
nnamessex River is lighted with two light-houses: Somer's Cove Light, 1 mile
isfield, and James Island Light, 2½ miles.
r Thoroughfare, Deil's Island, is a secure harbor for a section which relies al-
tirely on the waters as a means of transportation. Its trade consists of oyster
g and tonging, fish, general merchandise, trucking, and farming.
are over 400 vessels in the neighborhood engaged in the oyster and fish busi-
nploying 1,600 men, taking annually 450,000 bushels, valued at $135,000; about
ushels corn; 3,500 bushels white and sweet potatoes, and large numbers of
nelons. Truck of different kinds and fruits are transported, and there are
ral stores, selling goods to the amount of over $100,000 per annum.

APPENDIX H.

IMPROVEMENT OF PATAPSCO RIVER AND CHANNEL TO BALTIMORE, MARYLAND, AND OF THE HARBOR OF ANNAPOLIS, MARYLAND.

REPORT OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, *WITH OTHER DOCUMENTS RELATING TO THE WORK.*

IMPROVEMENTS.

1. **Patapsco River and Channel to Baltimore, Maryland.**
2. **Annapolis Harbor, Maryland.**
3. **Removing sunken vessels or craft obstructing or endangering navigation.**

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., August 12, 1886.

GENERAL: I have the honor to forward herewith the annual reports for the year ending June 30, 1886, for the works of improvement of rivers and harbors which have been in my charge.

In cases where the commercial statistics may not be as full and complete as desirable, it is not for want of effort on my part to have them so.

I have also been during the year supervising engineer of the districts in charge of Captains Bixby and Hinman, Corps of Engineers, and of Mr. S. T. Abert, United States agent, and of the district of Mr. W. F. Smith, United States agent, until November 28, 1885.

In addition I have been a member of several special Boards of Engineers, as reported in the regular monthly reports.

I resumed the charge of the improvement of the harbor of Annapolis, Md., December 20, 1885, receiving it from Mr. W. F. Smith, United States agent.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

H I.

IMPROVEMENT OF CHANNEL TO BALTIMORE, MARYLAND.

For want of funds the work of improvement was entirely suspe during the whole of the year ending June 30, 1886.

The available widths of the successive divisions of the channel, a depth of 27 feet at mean low water, were, June 30, 1885, at the clo operations, the following:

Craighill Channel ....
Cut-off Channel ....
Brewerton Channel ....
Fort McHenry Channel ....

Advantage was taken of the absence of the dredges, with their merous attendant tugs, scows, &c., to make a thorough resurvey of whole channel, the map of which has been prepared, with the ab general indications.

The channel left in an unfinished condition more than a year has teriorated considerably. The estimate of a year ago, for its complet to a uniform width of 400 feet, was $200,000. This is now increase $230,000, of which sum $150,000 have been appropriated by the law August, 1886.

Care has been taken of the property belonging to this improveme and in the office there has been the usual routine work of studies, ports, accounts, correspondence, records, &c.

Money statement.

July 1, 1885, amount available	$30,846
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	6,052
July 1, 1886, amount available	24,793
Amount appropriated by act approved August 5, 1886	150,000
Amount available for fiscal year ending June 30, 1887	174,793
Amount (estimated) required for completion of existing project	80,000
Amount that can be profitably expended in fiscal year ending June 30, 1888	80,000
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, BALTIMORE, MD.,
Collector's Office, July 27, 1886.

SIR: In compliance with your request of the 6th of May last, you are herewith fur nished with a statement of the commerce of the port of Baltimore for the fiscal yea ending the 30th of June, 1886, viz:

VALUE OF IMPORTS.

Free	$6,016,71
Dutiable	5,719,70
Total	11,736,41

COMPARED AS BETWEEN 1885 AND 1886.

otal value of imports, 1885	$11,853,317
otal value of imports, 1886	11,736,419
	116,898

The total value of imports of itself does not afford an intelligent showing of the siness of the port in that branch of trade.

A separate comparison of free and dutiable imports will make this apparent:

lue of dutiable imports, 1886	$5,719,701
lue of dutiable imports, 1885	4,833,984
Increase	885,717

* * * * * * *

COMPARISON AS BETWEEN 1885 AND 1886.

ties collected in 1886	$265,900 53
ties collected in 1885	184,870 58
Increase in 1886	81,029 95
ties due on merchandise in bond	155,272 32
ties due on merchandise in bond, 1885	125,123 03
Increase in 1886	30,149 29

SUMMARY OF DUTIES.

ties collected		$2,531,822 11
ties due on merchandise in bond		155,272 32
ties due on appraised merchandise transported in bond		12,649 70
ties due on merchandise transported in bond without appraisement		265,900 53
Total		2,965,644 66
scellaneous customs receipts	$41,421 88	
nnage tax	28,214 15	
		69,636 03
Grand total		3,035,280 69

COMPARISON AS BETWEEN 1885 AND 1886.

tal duties collected and due, 1885	2,314,762 62
tal duties collected and due, 1886	$3,035,280 69
Increase in 1886	720,518 07

* * * * * * *

VALUE OF FOREIGN EXPORTS.

xports in 1885	$45,041,634
xports in 1886	35,845,311
Decrease	9,196,323

* * * * * * *

arried in American vessels:	
Sail	1,555,687
Steam	3,408
Total	1,559,095
n foreign vessels:	
Sail	2,153,267
Steam	32,132,979
Total	34,286,246

NAVIGATION.

Entrances and clearances.	Number.	1
[illegible] entered from foreign ports.		
[illegible]		
[illegible]	130	
[illegible]	5	
[illegible]		
[illegible]	112	
[illegible]	319	
[illegible]	566	
[illegible] cleared for foreign ports.		
[illegible]		
[illegible]	162	
[illegible]	7	
[illegible]		
[illegible]	106	
[illegible]	350	
[illegible]	625	
[illegible]	1,514	9
[illegible]	1,664	1,2
[illegible]	3,178	2,1

[illegible] ....

[illegible] ....

[illegible] ....

REGISTERED TONNAGE.

Description.	Number of vessels.	Gross tonnage.	N tonn
[illegible]			
[illegible]	51	16,291.57	15,
[illegible]	1	622.25	
[illegible]			
[illegible]	23	12,208.56	11,
[illegible]			
[illegible]	573	30,594.08	29,
[illegible]	55	20,928.42	15,
[illegible]	9	2,207.58	2,
[illegible]	48	31,099.73	22,
[illegible]			
[illegible]	16	4,833.88	4,
[illegible]	1	189.12	
[illegible]			
[illegible]	402	4,534.94	4,
[illegible]	56	1,169.85	
[illegible]	4	110.70	
[illegible]	1,239	124,790.68	106,
[illegible] in fisheries	10	324.33	
[illegible] in coasting	681	95,286.16	80,
[illegible]	4	143.80	1
[illegible]	695	95,754.29	80,4
[illegible]	58	3,162.61	2,3
[illegible]	39	6,087.12	5,4
[illegible]	5	81.43	
[illegible]	2	766.89	7

[illegible] trade of this port may be properly mentioned in this connectio
[illegible] relations to the purposes of this exhibit.
[illegible] much of that trade is of great volume and value, and extends t
[illegible] seaboard and the Gulf of Mexico, and reaches San Francis
[illegible] tonnage carry coal from this port to the latter place during
[illegible]

The bay and river trade is equally important and valuable, and is steadily growing. Through this trade is received diversified products, which enter largely into the inland and foreign trade of the country.

In conclusion it may be remarked that a review of this exhibit will afford the proof that the growth and expansion of the commerce of this port is not a matter of local concern only, but one of general interest to the country.

I am, very respectfully,

JAMES B. GROOME,
Collector.

Col. WM. P. CRAIGHILL, U. S. A.

H 2.

IMPROVEMENT OF THE HARBOR OF ANNAPOLIS, MARYLAND.

Information was received towards the close of 1885 that shoaling had taken place in some portions of the harbor, and the freedom of navigation was thereby diminished. The necessary survey to determine the condition of the harbor could not be made until April, 1886, on account of continued high winds and ice. The map was completed in May and the work of dredging put under contract in June, 1886, after due advertisement. The contract was awarded to the lowest bidder, the American Dredging Company of Philadelphia. The work will be completed in 1886.

Money statement.

July 1, 1885, amount available	$9,205 98
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	436 99
July 1, 1886, amount available	8,768 99
Amount (estimated) required for completion of existing project	66,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	66,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

Abstract of proposals for dredging harbor at Annapolis, Md., opened at 12.05 *p. m., June* 17, 1886.

No.	Name.	Time.		In place.	In scows.
		Commence.	Complete.		
				Cents.	*Cents.*
1	Morris & Cummings Dredging Company	July 1, 1886	Sept. 15, 1886		20
2	Thomas P. Morgan		Nov. 1, 1886		8⅛
3	Baltimore Dredging Company	July 1, 1886	Sept. 30, 1886		13
4	George C. Fobes & Co	July 1, 1886	Sept. 1, 1886		13⅛
5	P. Sanford Ross		In 3 months	16¾	11
6	American Dredging Company		Aug. 10, 1886		8
7	James Caler & Son		In 3 months	12	9⅞
8	National Dredging Company		2 months		9

Contract with American Dredging Company.

H 3.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGI NAVIGATION.

By an indorsement of June 11 notice was received from the Ch Engineers of a wreck near Cove Point, Maryland, with instructic ascertain whether she was such an obstruction to navigation as to ju her removal by the United States in accordance with the law of Ju 1880.

Some unavoidable delay occurred in obtaining definite inform concerning this wreck. Her locality, condition, &c., were found the following: She is a schooner, named B. Oliphant. She sunk ruary 16, 1886, during a storm, bound out, about five miles NN Cove Point, in Chesapeake Bay. Her tonnage is 63.36 gross; age, 19 years, and the estimated value of the vessel was $2,000. Her consisted of about 71 tons of guano, which is now believed to be w less. Both masts show above water. Both vessel and cargo have abandoned by owners and insurers.

On the statement of the Engineer of the district, July 21, tha wreck was such an obstruction as to be a danger to navigation, recommendation that she be removed, authority was given for th moval July 30. Proposals for removal by contract have been calle and the immediate and entire removal of the obstruction is expec

APPENDIX I.

IMPROVEMENT OF THE HARBORS AT WASHINGTON AND GEORGETOWN, DISTRICT OF COLUMBIA—IMPROVEMENT OF THE POTOMAC RIVER AT WASHINGTON, DISTRICT OF COLUMBIA—IMPROVEMENT OF JAMES RIVER, VIRGINIA, AND OF SHENANDOAH RIVER, WEST VIRGINIA.

REPORT OF MAJOR PETER C. HAINS, CORPS OF ENGINEERS, BVT. LIEUT. COL., U. S. A., OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. **Harbors at Washington and Georgetown, District of Columbia.**
2. **Potomac River at Washington, District of Columbia.**
3. **James River, Virginia.**
4. **Shenandoah River, West Virginia.**

UNITED STATES ENGINEER OFFICE,
Washington, D. C., July 28, 1886.

SIR: I have the honor to transmit herewith my annual reports on the river and harbor improvements under my charge for the fiscal year ending June 30, 1886.

Very respectfully, your obedient servant,

PETER C. HAINS,
Major of Engineers,
Bvt. Lieut. Col., U. S. A.

The CHIEF OF ENGINEERS, U. S. A.

I 1.

IMPROVEMENT OF THE HARBORS OF WASHINGTON AND GEORGETOWN, DISTRICT OF COLUMBIA.

A history of the operations carried on previous to 1883 in the improvement of Washington and Georgetown harbors is given in my annual report for the fiscal year ending June 30, 1883.

At the beginning of the present fiscal year the work of excavating rocks in Georgetown Harbor that obstructed navigation was in progress. Certain groups of rocks, designated by the letters "K," "L," “M,” “N,” “O,” “F,” and “C,” were at the time being removed contract with Edward R. Lowe, of New York. The work was comp in November, 1885, and the contract closed. The removal of these makes the harbor of Georgetown safe for vessels drawing 20 fe water. There are other rocks close in to the wharf at G street, an other ledge that reaches out 50 feet or more from the wharves bet the Mill Race to the foot of High street. They are an obstruction to vessels that tie up near those wharves. Their removal would be the owners of wharf property in the vicinity, but at the present would be of little use to general commerce. In the future it may be necessary to remove them in order to increase the wharfage facilit Georgetown or to regulate the harbor lines.

It was thought better to leave their removal to be provided f special act of Congress.

After the completion of the rock excavation there remained a ba of $11,316.17. This sum was saved by reason of the low price at w the work was done. The dangerous rocks in Georgetown Harbor ha been removed, the $11,316.17 of the appropriation was reallotted t dredging of Georgetown Channel, and applied to deepening and w ing it above Long Bridge. The material dredged from the channe deposited on the Potomac Flats.

The amounts appropriated for this work are as follows:

June 11, 1870	$
March 3, 1873	
June 18, 1878	
March 3, 1879	
June 14, 1880	
March 3, 1881	
	2

The work is in the collection district of Georgetown, D. C., which is the port of entry. Nearest light-house, Jones Point, Virginia. Revenue collected year ending June 30, 1886, $21,364.30.

Money statement.

July 1, 1885, amount available		$18,
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$16,909 79	
July 1, 1886, outstanding liabilities	1,515 88	
		18,

Abstracts of contracts for improving harbors at Washington and Georgetown, D. C., during fiscal year ending June 30, 1886.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	A
1	Edward R. Lowe, New York City, N. Y.*	November 5, 1884	Removal of rocks	

* Completed.

'receipts and shipments at the harbors of Washington and Georgetown, D. C. during the fiscal year ending June 30, 1886.

rticles.	Quantity.	Value.	Articles.	Quantity.	Value.
............tons..	3, 827	$95, 675	Oil ....barrels..	1, 651	$6, 604
.......barrels..	26, 865	40, 297	Oysters ....bushels..	236, 245	94, 498
racite ....tons..	145, 467	727, 335	Paving blocks	245, 733	12, 286
inous ....do...	195, 105	536, 539	Potatoes ....barrels..	2, 869	5, 738
.............do...	16, 045	32, 090	Salt .... sacks..	3, 257	4, 885
............do ...	5, 495	219, 800	Sand ....tons..	50, 000	30, 000
............do...	2, 563	153, 780	Shingles	2, 181, 100	15, 267
ped) .barrels..	88, 000	440, 000	Stone ....tons..	8, 336	83, 360
at and corn), ...	65, 000	52, 000	Water and gas pipe .do ..	389	17, 340
...... tons..	89, 717	448, 585	Watermelons	329, 190	26, 335
ard measure), ...	32, b51, 000	527, 216	Wood ....cords..	25, 081	100, 324
....	12, 572, 500	28, 288	Total..............	....	3, 698, 242

owing table shows the amount of miscellaneous freight brought to these harnot included in the foregoing:

By steamer from—	Quantity, tons.	Estimated value.
....	12, 500	$1, 000, 000
....	6, 300	504, 000
....	2, 000	160, 000
....	43, 875	1, 096, 875
amers..	21, 300	532, 500
....	....	3, 293, 375

local passenger steamers not included.

F VESSELS OF VARIOUS CLASSES ARRIVING AND DEPARTING DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

drawing from 5 to 15 feet	1,050
awing from 10 to 18 feet	708
awing from 8 to 10 feet	70
awing from 4 to 8 feet	1,116
awing from 4 to 10 feet	363

nd local passenger steamers not included.

I 2.

EMENT OF THE POTOMAC RIVER AT WASHINGTON, DISTRICT OF COLUMBIA.

improvement was inaugurated by act of Congress passed August by which an appropriation of $400,000 was made. The next riation was made July 5, 1884, and was $500,000. Total amount riated, $900,000.

bject of the improvement is to widen and deepen the channels rgetown and Washington so as to accommodate the largest vest can reach Giesborough Point; to establish the harbor lines, the same time, to raise the marshes and flats on the city front overflow by the highest freshets, the material taken from the river in widening and deepening the channels to be used in fillin flats. The latter are to be raised until the portion above Long Bri 3 feet above the freshet slope of 1877, and the portion below the brid the same height at the middle line, from which it will slope toward channel to the margin of the fill, where it will be 6 feet above mea tide. A large tidal reservoir, not less than 8 feet deep, will be lished between Long Bridge and the sewer-canal, to supply fresh to the Washington Channel, which channel, at the upper end, w cut off from communication with the Virginia Channel. A smalle ervoir is to be established near the foot of 17th street for the pu of flushing the sewer-canal. The large reservoir is to be provided inlet and outlet gates of ample dimensions to fill it on the flood from the Virginia Channel, and empty it on the ebb tide into the W ington Channel. The plan contemplates the removal or rebuildi the Long Bridge on fewer piers with wider spans, and also that sewage now discharged into the Washington Channel be interce and conveyed to James Creek.

The condition of the river front at the time the first appropri was made had become so bad in a sanitary point of view, that ce parts of the city had become almost uninhabitable. This was ca by deposits, on the city front, of sediment from the river and the matter from the sewers which had formed flats or marshes, coverin area of several hundred acres. The Flats, on which there was a d growth of marsh-grass and reeds, were covered by water for about half the time, and uncovered the other half. In the latter condi they were exposed for a time each day to the rays of the sun, whic summer, produced favorable conditions for malarial diseases. Washington and Georgetown channels had not the depth and w that navigation required, and dredging was frequently necessary the relief of commerce. The depth of water on the bar below L Bridge was 16 feet, while on the bar above the bridge it was onl feet at mean low tide. A narrow channel through each was kept o by repeated dredging, as they immediately shoaled up after a fres During the years 1870 to 1881, inclusive, there had been appropriated dredging these channels and removing rocks in Georgetown Harbor, sum of $290,000, most of which was expended in trying to maintai narrow channel of 16 feet at low tide.

At the present time the condition of the work is as follows: Washington Channel has a depth of 20 feet at low tide along the front up to Long Bridge, the width being from 200 to 350 feet. Virginia Channel up to Georgetown has a depth of about 20 feet cept where it has shoaled by recent freshets), and a width varying f 300 to 500 feet. Nearly the entire portion of the Flats known as Sec I, viz, that part lying northwestward of the sewer-canal, has been f up to a height of about 6 feet or more. On Section II, viz, that por of the Flats between the sewer-canal and Long Bridge, about 6, linear feet of embankment forming the margin of the tidal reser has been built, and the excavation for the tidal reservoir itself been commenced. Of Section III, the part of the Flats below L Bridge, about 212 acres, have been filled to a height above overf at high tide. Total amount thus far filled to a height above overflow ordinary high tides, 375 acres.

During the past pear 1,686,183 cubic yards of material were dred and deposited on the Flats. The most of the dredging was done means of hydraulic machines of the Von Schmidt pattern, the mate being put ashore through pipes.

The first contract with Benson & McNee was for 1,000,000 cubic yards to be dredged from the Washington Channel and deposited on Section II of the Flats. This contract was in progress at the beginning of the fiscal year. It is now practically completed. There only remains about five days' work to be done, when the contract will be closed. The final measurements to determine the exact quantity of material deposited on the Flats under this contract cannot be made for some time, however, owing to the fluid-like condition of that last dredged. Nearly all the material taken from the Washington Channel is soft mud, and when stirred up with water, as is done by the hydraulic dredge, maintains a semi-fluid condition for a considerable length of time. The drying out process is a slow one at best; but in this case, it has been greatly retarded by rainy weather. The price paid for the Washington Channel work is 12.37 cents per cubic yard, measured in place on the Flats after the water has run off and the material is compacted.

Contract No. 2, with Benson & McNee, was for 1,000,000 cubic yards to be dredged from the Virginia Channel above Long Bridge, the dredgings to be deposited on the Flats. This contract is, at the present time, only about one-half completed. The work has been retarded by various causes. The material was found to be more difficult to dredge than was anticipated by the contractors. A large part of it was found to be sand, which is very destructive of the pumping machinery. Much time was therefore lost in repairing the damages done by the sand-blast inside the pump. It was also found that when the material consisted largely of sand a much greater quantity of water had to be pumped in order to keep the sand moving through the pipes; and the water must be driven with greater velocity. Even then there is danger of its accumulating in the discharge-pipes and choking them. This frequently happened when the end of the discharge-pipe was high and at a long distance from the pump. The price paid for dredging and depositing the material on the Flats under this contract is 15.45 cents per cubic yard. It is worthy of note that the sand pumped up from the river and discharged on the back part of the fill, is actually worth, for building purposes, from 50 to 75 cents per cubic yard.

When the third contract was awarded to Benson & McNee it became necessary to build a third machine. This they did, giving her more powerful engines, and adding a few improvements that experience had shown to be expedient.

It was expected that this machine would do certain parts of the work under contract No. 2, for which the other two machines had not sufficient power. The new machine was put to work the latter part of September, 1885, and worked on the Virginia Channel until winter put a stop to operations. On the night of June 19, 1886, she was totally destroyed by fire, inflicting a severe loss on the contractors, and causing a temporary suspension of work under this contract.

Contract No. 3, with Benson & McNee, was for dredging the Virginia Channel below Long Bridge and a portion of the tidal reservoir, 700,000 cubic yards in all, at 15 cents per cubic yard, measured in place. The work was begun in September, 1885, and is now in progress. The dredging in the Virginia Channel is finished, about 500,000 cubic yards having been deposited on the Virginia side of Section III; that of the tidal reservoir, about 200,000 cubic yards, is about one-third done. Unless some unforeseen accident happens, this contract should be completed by the middle of August, 1886. The material from the tidal reservoir is deposited on the Flats adjacent to the Monument grounds.

The following table gives a summary of the work done by eac of the three hydraulic dredges engaged on this improvement:

Summary of work done by each hydraulic dredge engaged in improving the Potoma near Washington, D. C., during the year commencing July 1, 1885, and ending J 1886 (exclusive of January and February).

Date.	Dredge No. 1.			Dredge No. 2.			Dredge No.	
	Actual engine hours.	Estimated cubic yards dredged.	Average cubic yards per engine hour.	Actual engine hours.	Estimated cubic yards dredged.	Average cubic yards per engine hour.	Actual engine hours.	Estimated cubic yards dredged.
July, 1885	331¾	39,325	118	338½	94,157	278	....	....
August, 1885	205	20,947	102	378	73,266	194	....	....
September, 1885	231¼	38,271	165	224½	45,450	202	....	....
October, 1885	453¾	97,800	216	359	59,375	165	214	25,232
November, 1885	341¾	62,282	182	367	60,159	164	330½	45,267
December, 1885	443	88,590	200	274	28,287	103	311½	48,348
March, 1886	342	76,303	223	303	41,250	136	405	79,842
April, 1886	374½	60,049	160	375½	48,287	129	304½	68,188
May, 1886	214	35,152	164	364½	50,685	139	267	58,017
June, 1886	370	72,442	196	419½	75,329	180	*182	34,772
Totals	3,307	591,131	179	3,403½	576,245	169	2,014½	359,666

*This dredge was burned June 19, after having worked .65 of that month.

NOTE—The number of cubic yards dredged is taken from the inspectors estimates as meas *situ*, and is somewhat less than the actual amount.

It is to be noted that the endeavor has been to run each ma continuously night and day, except Sundays. The total number c gine hours made in a month is the maximum that each machine capable of. The remainder of the time was lost in repairs, clea boilers, drawing fires, moving machine, taking out obstructions, ar ing pontons and pipe joints, and by freshets, ice, wind, &c. machine was laid up the greater part of January and February o count of ice, and those two months are not included in the staten The capacity of each machine depends on the character of the terial, the height of discharge, the length of the discharge-pipe, an velocity at which the pump is run. In soft mud progress is quite r As much as 7,000 and 8,000 cubic yards have been dredged in one An average of 400 cubic yards per hour is often attained. In progress is slow, and much time is lost in repairs.

The material in the river varies greatly. In some places it con almost entirely of sand, in others of mud. Then again there are tures of each in varying proportions, and strata of varying thick The greatest length of discharge-pipe at any time was about 3,500 and the greatest height to which the material was discharged abo feet above the level of low tide.

The formation of an embankment along the southeast side of the reservoir, and the outside margin of the fill between the site of th let gates and Long Bridge, was in progress at the beginning of the 1 year. This work was done by hired dredging-machines, and wa ished in November, 1885.

One hundred and eleven thousand nine hundred and thirty-five c yards of material were dredged and deposited in embankment at a to the United States of 8.4 cents per cubic yard. The lowest bid fo work, under proposals advertised for in the usual way, was 16 cent cubic yard, being very nearly double that at which it was subsequently done by hired labor. The past winter and spring have been noted for the great number of freshets. Though none of them caused a rise in the river at this place higher than about 6½ feet above mean low tide, their frequent recurrence kept up a swift down-stream current, which retarded work and caused an injurious deposit of sediment in the dredged channels. The water of the Potomac, which during the spring and summer is usually quite clear, has been discolored almost continuously with the washings from the upper river. In the Washington Channel there was a fill of no less than 4 feet a short distance below Long Bridge; and in the Virginia Channel above the bridge and immediately below the contracted part of the river, there was a fill of nearly the same amount. It has been necessary thus far in carrying on the work to keep open the Washington Channel to aid in the discharge of freshets; and until the cross-section of the Virginia Channel had been increased, it was thought unsafe to do work on Section II that would materially diminish the freshet discharge across that part of the Flats. The work has now reached that stage of progress when it is not only desirable, but important, to close the upper end of Washington Channel in order to prevent these freshet deposits. As soon as the embankment along the outer margin of Section II is up to a height of 6 feet or more, it is thought the width of the river will be sufficiently contracted to prevent injurious deposits above Long Bridge; and as the Washington Channel will be closed at the upper end, no appreciable amount of sediment will be swept into it.

The recurring freshets not only retarded work and damaged to some extent the dredged channels, but some of the embankments made on Section II, just above Long Bridge, were also damaged. Indeed, we must be prepared to have the work damaged by every freshet until it has progressed further toward completion. Taken altogether, the damage done by the freshets and ice during the past year was comparatively small, and most of it could have been avoided had an adequate appropriation been made in 1885.

During the month of December, 1885, an examination was made of the site of the proposed sluice-gates. Their location will be about 1,200 feet from Long Bridge. Borings were made with an artesian-well tube to a depth of about 70 feet below mean low tide. The soil was found to consist chiefly of mud and sand, in strata of varying thicknesses, with some gravel, the mud strata in some cases being very soft. At a depth of about 70 feet there were indications of rock in close proximity. Further examination was stopped by the very cold weather that set in. The borings showed conclusively that a pile foundation will be necessary for the inlet gates; but an unexpected feature was the discovery of gas under considerable pressure. This gas appeared to be in pockets, and at various depths from about 26 feet to 65 feet below the level of low tide. At 65 feet the pressure was great enough to throw out stones, gravel, and mud to a height of 15 or 20 feet above the top of the pipe. The gas was inflammable, and burned with a clear flame, the flow continuing for some hours after being tapped, the pressure becoming more and more feeble until the gas ceased to flow altogether. It is supposed to be marsh-gas, but further examination will be made.

SEWER-CANAL.

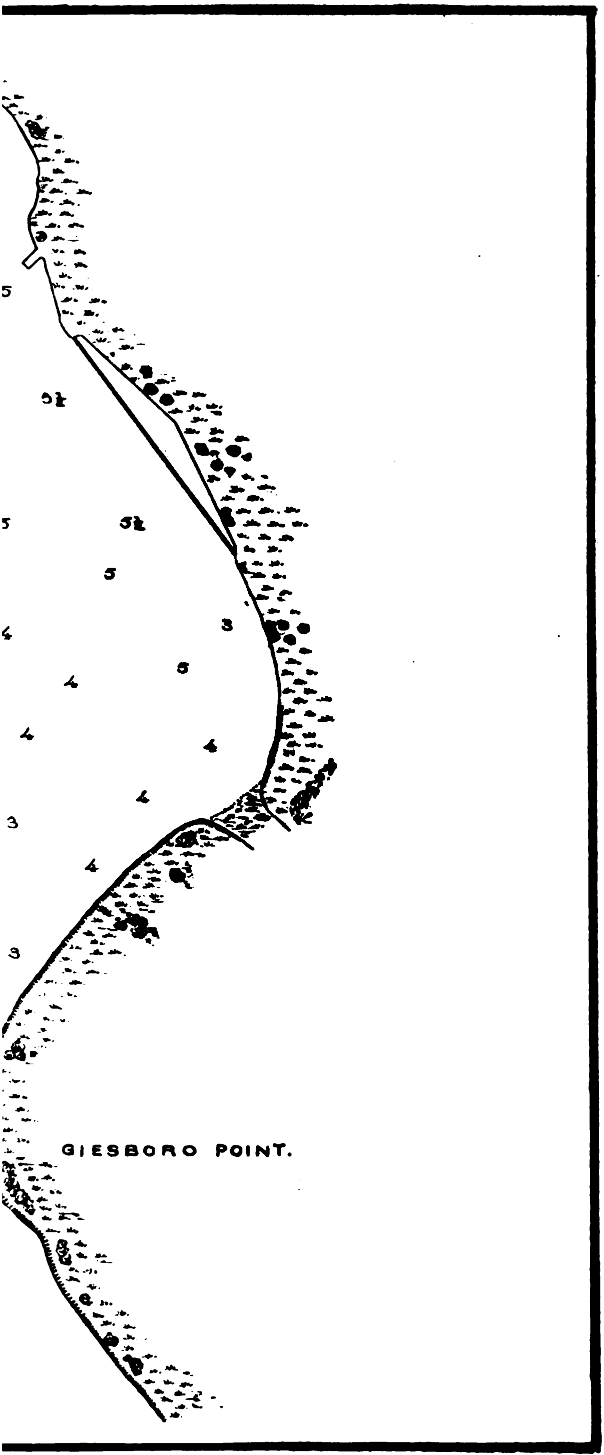
The necessity of Congressional action relative to the sewer-canal at the foot of Seventeenth street becomes more and more imperative each year. It will be remembered that one of the largest sewers in the city

discharges at this point. Formerly it discharged the se
Flats, but within a few years a canal has been cut across the Fl
have from time to time been raised, and the Flats on each s
now being filled in. The sewage discharged into this canal i
year by year. The canal is not a proper receptacle for it, as
current in it except that produced by tidal action and the
accretions from the sewer itself. As a consequence, the h
canal, and sometimes its entire length (about 3,500 feet), is
a sickening mass of fœcal matter, the odors from which a
pleasant. A single visit at such times will suffice to give
idea of its present condition. It is sometimes suggested that
should be extended out over the flats and into the river.
ceive to be objectionable. It would not remove the present
it would merely hide it from view. The gases that now ema
this mass of corruption would be retained in the sewers to be d
through ventilators into the city, and perhaps largely into
houses. The most satisfactory solution of the problem woul
be to close the present end of the sewer and establish a la
pump there, to pump the sewage out into the river, or as f
may seem necessary; the closure of the sewer to be made b
open either automatically or otherwise, during a rainfall, the
which would be discharged into the canal. The latter, unde
cumstances, would only receive rain-water contaminated by
age. This was, substantially, the plan recommended by C
Greene, Corps of Engineers, United States Army, while assis
Engineer Commissioner of the District. If some such plan
carried out by the District authorities, it would appear to be
and right for the Government to take care of the canal itsel
taining-walls to its sides, and establish flushing sluices from
reservoir near its head. An estimate was submitted for c
taining-walls in December, 1882. Their cost will be about
and an appropriation of $100,000 is recommended to begin t
their construction.

LONG BRIDGE.

The attention of Congress is again called to the necessit
in regard to Long Bridge. The plan recommended by the
Engineers for the improvement of the river front contempla
building of Long Bridge at an early period during the prog
improvement, with wide spans upon piers affording the lea
obstruction to the flow of water. No plan of improvement ca
satisfactory while the bridge remains as it is—a serious obst
the flow of water beneath it. A large amount of riprap ston
time to time been placed around the piers for their protectio
gether with the piers themselves, which are set obliquely to t
current, form a partial dam across the river, which will al
menace to the improvement. The dredging in the Virgini
above and below this bridge, has had to be stopped some dist
it for fear of injuring the foundations of the piers. The bri
to be rebuilt without unnecessary delay.

The financial statement shows a balance of $122,237.06 as a
available for work. Practically there is nothing available.
money is needed to meet liabilities to be incurred under exi
tracts, and none of it can be applied to any other portion of
All of it would have been expended before this but for the
delays that have occurred in the prosecution of the work.



THE AMERICAN GRAPHIC CO., N.Y.

been an unfavorable one for rapid progress, and the contractors for lging have been unfortunate in losing their best and most powerful lging machine.

, is of the utmost importance that one large appropriation be nptly made in order that the work may be put in a safer condition. ts present condition it is subject to damage by freshets, ice, and even igh winds, which cause destructive wave action on the unprotected ankments. The prompt expenditure of about $800,000 would be an omical measure. After that smaller appropriations would suffice, then be deemed expedient to have the work progress slowly.

ith liberal appropriations the improvement can be completed within estimates, and, when completed, the value of the land reclaimed will ully equal to the cost of reclamation.

shington City is in the collection district of Georgetown, D. C. The amount of nue collected and the commercial statistics are given in the report of the improve- t of Washington and Georgetown harbors. Nearest light-house, Jones' Point, inia.

Money statement.

1, 1885, amount available		$358,027 93
1, 1866, amount expended during fiscal year, exclusive liabilities outstanding July 1, 1885	$197,602 12	
1, 1886, outstanding liabilities	38,188 75	
		235,790 87
1, 1886, amount available		122,237 06
ount appropriated by act approved August 5, 1886		375,000 00
ount available for fiscal year ending June 30, 1887		497,237 06
mount (estimated) required for completion of existing project		1,441,365 00
mount that can be profitably expended in fiscal year ending June 30, 1888		800,000 00
ibmitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.		

---

ract of contracts for improving Potomac River in the vicinity of Washington, D. C., in force during the fiscal year ending June 30, 1886.

Names and addresses of contractors.	Date of contract.	Subject of contract.	Price per cubic yard.
			Cents.
Benson & McNee, San Francisco, Cal	Aug. 28, 1884	Dredging	12.37
.....do	Sept. 29, 1884	....do	15.45
.....do	Mar. 16, 1885	....do	15
G. Vanderwerken, Georgetown, D. C*	Mar. 16, 1885	Riprap stone	85

*Completed.

I 3.

IMPROVEMENT OF THE JAMES RIVER, VIRGINIA.

he improvement of the James River was regularly undertaken by the ernment in 1870. A small sum had been expended previous to 1855 er the direction of Colonel De Russy, Corps of Engineers, Un es Army, and was of some advantage to navigation.

The next appropriation was made in 1870, since which time a
priations have been made as follows:

Year.	Amount.	Year.	Amount.	Year.	A
1870	$50,000	1875	$50,000	1881	
1871	50,000	1876	60,000	1882	
1872	50,000	1878	70,000	1884	
1873	75,000	1879	75,000		
1874	50,000	1880	75,000	Total	

The city authorities of Richmond, Va., have also expended the
of $444,696.45

The expenditures during the fiscal year ending June 30, 1886, w
$16,696.95.

When the improvement was undertaken by the Government nav
tion was obstructed by sunken vessels, by remains of military brid
and by obstructions purposely put in the river during the late wa
prevent the National fleets from approaching too close to Richm
There were, besides, natural obstructions.

Rocketts Reef and Richmond Bar had only 7 feet of water at n
low tide; from Warwick Bar (where the depth was 13 feet) to R
mond the channel was crooked and obstructed by dangerous rocks
ledges. The Dutch Gap Cut-off, which now saves 5½ miles of diff
navigation, was not then open.

The original project was to secure a depth of 18 feet at full tide,
responding to 14.5 feet at low tide, to Richmond, with a channel wi
of 180 feet from Harrison's Bar to Richmond docks, the excavatio
rock to be 18½ feet at full tide. This project was well advanced w
Congress, by act approved July 5, 1884, adopted the project of 22
at mean low tide from Richmond to the sea. Operations during
past year have been conducted under this project.

In carrying it out a large amount of excavation will be in solid r
and the cost will necessarily be great. The width to be given to
channel is 400 feet from the sea to City Point, 300 feet from City Poi
Drewry's Bluff, and 200 feet from thence to Richmond.

The methods employed for improving the river consist in dredg
rock excavation, and contraction of water-way by means of dike
jetties.

Owing to the failure of the river and harbor bill of 1885 the op
tions of the last fiscal year were restricted to an endeavor to main
the channel existing at the beginning of it. The expenditures w
devoted entirely to dredging. The city authorities of Richmond,
have also expended the sum of $12,524.47 during this same period
that $29,221.42 represents the amount expended during the yea
maintaining the conditions existing at the beginning of the year.
can hardly be said that this has been fully done, as the depth no
perhaps a fraction of a foot less than it was a year ago, and there
remains a considerable quantity of sand to be removed from the har

The year has been remarkable for the number of high freshets. T
were five freshets reaching a height of 16 feet and upward. As a
sequence, there has been an immense quantity of sand and silt depos
in the river, which it was necessary to dredge out, or allow it to obst
navigation. The greater part of the sand and gravel brought dow
the freshets lodges in the harbor above and near the ship-locks.
siderable was deposited on Randolph Flats and below, while at Fal

ek, below the works of contraction, an entirely new shoal was developed. No appreciable deposit of sand appears to have taken place on section of the river between Gillies Creek and the upper part of Ranlph Flats.

Besides the freshets there were two ice-gorges. In one case the ice med almost a solid mass to the bottom of the river. Several large mers tried to break it, but failed. Luckily it broke up by a gradual w. The ice in the harbor caused a large amount of sand, composing bar just above the ship-locks, to be washed out and deposited in the nnel between the locks and Gillies Creek. This deposit is now being oved by the city authorities at their own expense.

Prior to the first freshet in January, 1886, a channel 18 feet deep at tide had been made through Randolph Flats Bar, and for some dice below. The subsequent freshets filled up the dredged channel d made it necessary to redredge a part of it. A remarkable feature connection with the filling at Randolph Flats is a fill that took place tween Jetties No. *14 and No. *16. This particular place has been edged several times before. After the freshet the water was deeper tside the cut than in it. Evidently there is some local cause for this, d it will be investigated. At Falling Creek, just below the works of ntraction, a new shoal made its appearance immediately after the bsidence of the January freshet. The depth had decreased to about 4 feet at mean low tide. In dredging a cut through this shoal the mains of an old military bridge were found, built on cribs filled with one. There were removed from the cut 29,600 cubic yards of sand, 9 cubic yards of rock (used for sinking cribs of bridge), and 122 logs.

In dredging Randolph Flats there were removed 92,720 cubic yards f sand and 950 cubic yards of gravel.

During the month of May an examination was made of the dredged t through Swan Point Shoal. As stated in my last annual report, it was expected that, on account of the local characteristics of the river at this place, a dredged channel would be permanent without works of contraction. It was found that the cut, made more than a year ago, had not only maintained itself, but that it had considerably deepened. The exact increase of depth has not been determined, as no regular survey has yet been made.

The experience of the past year has demonstrated what was stated in the last annual report, viz, that an annual expenditure will be required to maintain the river in navigable condition after it has been improved. This arises from the fact that the freshets bring down immense quantities of solid material, which is deposited in the bed of the river whenever the current is too sluggish to keep it moving. If the appropriation made by act of July 5, 1884, had all been expended on June 30, 1885, the navigable depth to Richmond would have been reduced to 12 feet, or less, at mean low tide.

The channels, as a rule, where the works of contraction have been well advanced, maintain themselves; the most of the deposits takes place above and below these works. Such was the case the past year. The deposit of sand above Gillies Creek was immense. The deposit at and near Falling Creek has been going on for several years, and was not so great. At Randolph Flats, where the works of contraction are well advanced, the deposit was not great, though the dredged channel was obliterated. The cross-section of the river was rather increased, though the available depth was reduced. At other points above Randolph Flats the deposit was not large, but is supposed to be due largely to the lodgment of snags, wrecks, &c., which quickly cause a shoal to form around them. Unless they be promptly removed, they obstruct gation.

The disposal of spoils in dredging the upper part of the James I is fast becoming a serious problem. The areas between the spur d built to contract the stream have heretofore been the dumping-gr for all dredgings, and they have been of great value. These sp however, are now becoming filled up, so that dumping scows of lightest draught can only get in at high-tide, and in many places not get in at all. It is necessary to find new dumping-grounds, or material must be transported in some other way. The latter is do less the better plan, particularly as the time approaches for connec the ends of the jetties by longitudinal training-dikes. When thi done the spaces referred to will be closed in.

The present condition of the improvement may be stated as follo There is 19½ feet of water at full tide (17½ feet at low tide) from the to Kingsland's Reach; 18 feet at full tide (14.5 feet at low tide) fi thence to Randolph Flats, and about 17 feet (13.5 at low tide) fi thence to Richmond.

There has been expended on the new project, the estimate for wh is $4,500,000, the sum of $94,673.33.

To make reasonable progress in an undertaking of this magnitu large annual appropriations will be necessary. A sum estimated fr $15,000 to $30,000 will be needed annually to remove the deposits freshets. Four hundred thousand dollars, therefore, would seem to a moderate sum to apply in execution of this project. This amou could be profitably expended in the fiscal year 1888.

Money statement.

July 1, 1885, amount available	$19,256
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	16,696
July 1, 1886, amount available	2,559
Amount appropriated by act approved August 5, 1886	112,500
Amount available for fiscal year ending June 30, 1887	115,059
Amount (estimated) required for completion of existing project	4,273,570
Amount that can be profitably expended in fiscal year ending June 30, 1888	400,000
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

Table showing freshets in the James River, Virginia, and the heights to which they rose Richmond.

Date.	Height above mean low water.	Date.	Heigh above m low wat
	Feet.		*Feet.*
Unknown	13.30	January 17, 1877	10.
Do	13.05	April 10, 1877	6.
Do	12.65	October 5, 1877	12.
1847	16.50	November 9, 1877	11.
1863	16.79	November 25, 1877	28.
1864 (?)	16.10	January 15, 1878	8.
October 1, 1870	27.02	February 11, 1878	7.
February 26, 1875	14.38	April 11, 1878	5.
December 9, 1875	5.60	May 7, 1878	6.
March 30, 1876	12.00	May 16, 1878	6.
September 24, 1876	12.19	September 15, 1878	12.

Table showing freshets in the James River, Virginia, &c.—Continued.

Date.	Height above mean low water.	Date.	Height above mean low water.
	Feet.		*Feet.*
November 18, 1878	12.75	January 7, 1884	7.70
December 12, 1878	12.62	February 11, 1884	10.60
January 16, 1879	7.80	March 11, 1884	13.70
December 15, 1879	9.82	March 27, 1884	15.70
February 15, 1880	6.76	June 15, 1884	8.40
March 15, 1880	13.32	June 28, 1884	9.30
May 2, 1880	6.90	May 28, 1885	9.90
January 22, 1881	10.40	October 31, 1885	15.90
February 13, 1881	12.95	January 7, 1886	15.10
December 27, 1881	10.60	February 14, 1886	12.70
February 11, 1882	11.00	April 2, 1886	24.30
January 21, 1883	9.70	April 8, 1886	17.00
April 18, 1883	9.70	May 9, 1886	16.30
April 26, 1883	8.80		

COMMERCIAL STATISTICS FOR FISCAL YEAR ENDING JUNE 30, 1886.

Value of domestic exports	*$2,471,213 00
Custom-house receipts from all sources	10,635 79
Number of vessels entered from foreign ports	26
Number of vessels cleared to foreign ports	70
Number of vessels entered from domestic ports	547
Number of vessels cleared to domestic ports	455

HARBOR-MASTER'S STATEMENT.

Number of vessels, with amount of tonnage, arriving at the port of Richmond, Va., during the fiscal year ending June 30, 1886.

	Number.	Tonnage.
Barks	23	....
Brigs	29	....
Schooners	530	200,000
Steamers	290	550,000
Total	872	750,000

NOTE.—The above table does not include river or bay vessels, tugs, or river steamers.

I 4.

IMPROVEMENT OF SHENANDOAH RIVER, WEST VIRGINIA.

Congress, by act of June 14, 1880, made an appropriation of $15,000 for improving the Shenandoah River, West Virginia. By act of March 3, 1881, an additional appropriation of $2,500 was made for the same object. A proviso was added to the latter act, to the effect that neither of these appropriations shall be expended "until any corporate rights or franchises that may exist over said river shall have been relinquished to the United States to the satisfaction of the Secretary of War." This condition has been complied with.

The project for the improvement is to rebuild the locks, dams, and chutes of the old Navigation Company, so as to secure a down-stream

navigation of about 18 inches. No work has been done, howev
further legislation of Congress has been asked.

Money statement.

July 1, 1885, amount available	$16,
July 1, 1886, amount available	16,

PLANS FOR CONSTRUCTION OF BRIDGE ACROSS THE POTOMAC RI

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY
Washington, D. C., June 23, 18

SIR: I have the honor to return herewith the resolution of the
ate of the United States of the 24th ultimo, which was referred to
office for report, directing the Secretary of War to "examine and re
upon the expediency of constructing a Government bridge, with a
able draw and approaches, from a point at or near the foot of New
or New Hampshire avenue, on the public grounds, across the Pot
River and Analostan Island to a point on the United States national
etery grounds at Arlington," with estimate of cost, &c., "as well a
cost of alternative plans," &c., and to submit the inclosed copy o
report thereon of Maj. Peter C. Hains, Corps of Engineers, dated
21st instant, to which attention is invited.

Major Hains has given the subject such consideration as the lin
time and means at his disposal would permit, and his views, clearl
succinctly stated, are entitled to consideration. The plans he su
are for draw-bridges only, and he is of opinion that "a bridge some
ornamental in design, with a wide draw, built on stone piers, with
spans, so as to allow ample area for the discharge of freshets, w
seem to meet all actual wants." He estimates the cost of the brid
would propose, viz, "an iron truss with four spans of about 300 feet
the second span from the Washington City side to be a pivot dr
&c., at $609,543. An alternative span with three spans built of s
draw-span 350 feet, otner plans, 425 feet each, would, he thinks,
about $650,000.

In connection with this subject, and having reference to the clau
the resolution relative to alternative plans, I have to submit the incl
copy of a communication to this office, dated June 7, 1886, from
Thomas W. Symons, Corps of Engineers, submitting a design for a b
"from Observatory Hill to Arlington, across the Potomac River," w
it will be observed, is a high bridge of an ornamental as well as
umental character. It does not appear that Captain Symons h
lowed sufficient head room. He estimates the cost of a bridge desi
as shown in the drawings accompanying his communication at
$1,000,000 to $1,500,000.

It may be added that the limited time given for so important a
ject rendered it impracticable to give more than a casual study o
question.

The proposed structure, whether viewed from a local or a national s
point, would involve interests of such magnitude and importance
demand, in my judgment, the careful consideration of a mixed Boa
Engineers, whose duty it should be to give the plans to be adopte

construction the fullest and most careful consideration, and it is recommended, should Congress provide for its construction, that such a Board be authorized.

Very respectfully, your obedient servant,

JOHN NEWTON,
Chief of Engineers,
Brig. and Bvt. Maj. Gen.

Hon. WM. C. ENDICOTT,
Secretary of War.

REPORT OF MAJOR PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., June 21, 1886.

SIR: The following resolution of the Senate was referred to me, by indorsement of the Chief of Engineers, Unites States Army, for report:

IN THE SENATE OF THE UNITED STATES,
May 24, 1886.

Resolved, That the Secretary of War be directed to examine and report upon the expediency of constructing a Government bridge, with a suitable draw and approaches, from a point at or near the foot of New York or New Hampshire avenue, on the public grounds, across the Potomac River and Analostan Island, to a point on the United States national cemetery grounds at Arlington, so as to connect, in the best manner, the public grounds on the two sides of the Potomac, with estimates of the cost of the kind of bridge deemed by the Department most expedient, as well as the cost of alternative plans considered practicable, and which will not materially affect the navigation of the river.

Attest:

ANSON G. MCCOOK,
Secretary.

The expediency of constructing such a bridge as the resolution calls for has been discussed for several years without apparently developing a dissenting opinion. Indeed, no argument is needed to show the expediency of a bridge of some kind other than a glance at the map* of Washington and Georgetown harbors, transmitted herewith. The filling of the Potomac Flats will reclaim an area of about 750 acres of land along the river front on the Washington side. From the Capitol to the Monument Grounds there is already an area of 373 acres of public land laid out in parking, to which the reclaimed Flats will be connected. A bridge from the latter to Arlington will connect the whole system. Arlington Cemetery, where the remains of so many gallant soldiers of the Union rest, is a place of resort of the majority of visitors to the national capital, and would be to many people of the District if there were better facilities for reaching it. The route by way of Long Bridge is so long that it is almost impracticable to pedestrians. It is unsafe for carriages drawn by spirited horses, and is too narrow to afford proper facilities. The route by way of the Aqueduct is but little better, and in its present condition less safe; besides it is not a Government bridge, and annoying tolls are exacted from every one crossing it. A short line of communication that would be available to pedestrians as well as for those who ride is very desirable. The shortest and least expensive route is that indicated on the accompanying chart. This line is almost a direct prolongation of New York avenue, and would place the bridge about midway between the Aqueduct and Long Bridge; so that whether the

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* Omitted.

Aqueduct be made a free bridge or not, this would be a desirab provement.

The only question is, What shall be the character of the br There is no limit to the number of different kinds of bridges th practicable, and that will not materially affect the navigation o river. A bridge somewhat ornamental in design, with a wide built on stone piers, with wide spans, so as to allow ample area fo discharge of freshets, would seem to meet all actual wants.

Such a structure would cost comparatively a small sum of m but, if the bridge be designed as a monumental structure, it can be done at considerable increase of cost.

I have had made an accurate cross-section of the river bed-alon line of the proposed bridge, and a number of borings to determin depth to solid rock. These are indicated on the accompanying tra The depth to rock, from the surface, varies, as will be seen, from 42 feet. The conditions are, therefore, favorable for the erectio heavy structure.

The plan of the bridge that I would propose, is that of an iron with four spans of about 300 feet each; the second span from the ington City side to be a pivot draw (see sketch* herewith.) The will thus be in the deepest water, easy of access, and directly i channel-way of the river. The bridge to have carriage-way 2 wide, and two sidewalks, each 8 feet wide. The main bridge stru will be about 1,200 feet long. The approach on the Washingto to be by a wide roadway on an embankment with a grade of 3 feet in 100. Analostan Island and the bed of Little River shou crossed partly by an embankment and partly by open trestle sup ing the roadway, the proportion of embankment and trestle work so calculated as to give an open area sufficient, in addition to the a the main river, to discharge the highest freshets.

The lower chord of the bridge should be placed at about 28 feet the level of low tide; this would allow tugs and small craft to pass the bridge without opening the draw. The piers and abutments built in the most substantial manner of solid masonry; the truss capable of bearing a moving load of about 75 pounds to the squar of roadway.

A bridge of this kind will, in my opinion, best fulfill the requiren of the Senate resolution, viz:

> A Government bridge, with a suitable draw and approaches, so as to connect best manner the public grounds on the two sides of the Potomac.

The cost of such a structure, finished in the best manner and some degree of ornamentation, it is estimated, would be as follow

Two abutments and approaches, including excavation, coffer-dam, pumping, &c	$
Three channel piers, including excavation, coffer-dam, leveling rock to receive foundation courses, &c	1
Draw-pier	
Two guard-piers	
Pile and timber connections	
Three truss spans, including erection of false works, &c., at $35,000 each	1
One draw-span	
300 feet (linear) iron trestle bridge across Analostan Island	
125,000 cubic yards embankment, at 25 cents per cubic yard	
Contingent and office expenses, &c	
	6

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* Omitted.

The cost of the bridge could be reduced by increasing the number and reducing the width of the spans, but such reduction would not be expedient, as it is important to keep the number of piers down to the minimum, in order not to obstruct the flow of water.

A variation in the form of truss could be made by curving the upper chord, and to some this modification would have a more pleasing effect. The cost would be practically the same.

An alternative plan would be a three-span truss, built of steel, and with the upper chord either curved or straight. The draw span, in this case, to be about 350 feet. The other two spans, about 425 feet each. In other respects, the bridge would be like the four span structure already referred to. It would have one great disadvantage, however, as the draw-span would be located partly in shoal water, so that vessels, as a rule, would use only the side toward the Washington shore.

The cost of a three-span bridge would be about $650,000.

The resolution of the Senate calls for the cost of alternative plans considered practicable, and which will not materially interfere with navigation. There are many plans of high bridges entirely practicable, which will not interfere with navigation, but it will take several weeks at least to prepare even a few such plans, with reliable estimates of cost, and as this report is wanted immediately, no attempt will be made to do so.

There may be a great diversity of opinion as to the height necessary to build a bridge, in order that it may not *materially* interfere with navigation. If navigation interests alone were consulted, a clear height of at least 140 feet would be considered necessary. In these days of sharp competition, every obstacle to free navigation in any port tends to drive trade to other outlets. To require all or nearly all sailing vessels that trade to Georgetown to lower their topmasts, for instance, would be regarded as a great hardship by their owners. To build a bridge high enough for them to go under without so doing would add immensely to the cost of the structure. It must not be forgotten that the Government has at great expense improved the channel approaches to Georgetown, so that larger vessels can now reach it. Is it good policy to interpose what would be considered a serious obstacle of another kind? Ordinary trading schooners have their topmasts rigged so that they can be taken down and replaced with facility.

A bridge, then, if built without a draw, would need to be about 140 feet above high tide. To construct such a bridge, whether it be a suspension, a cantilever, or arched bridge, would be an expensive undertaking the cost running up into the millions.

Very respectfully, your obedient servant,

PETER C. HAINS,
Major of Engineers,
Brt. Lieut. Col., U. S. A.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF CAPTAIN THOMAS W. SYMONS, CORPS OF ENGINEERS.

WASHINGTON, D. C., *June* 7, 1886.

GENERAL: I have been for some time specially interested in the subject of a bridge from Observatory Hill to Arlington across the Potomac River.

I have designed a bridge for this location, and I have the honor to send you herewith sketches and a general description of it, together with an approximate estimate of its cost.

The bridge is designed to furnish a wide travel-way from the c to the national cemetery and extensive Government estate at A ton; to pass at a sufficient height above the river to incommode merce in the least possible manner; to be monumental in its chara artistic in all its details, and pleasing in general effect.

The main idea to be expressed by the bridge is embodied in the eral description sent herewith—that it is a monument to Lincoln Grant.

It seems peculiarly fitting that the nation's monument to these g men should take the form of a noble bridge across the river which s rates the two sections late in arms against one another. It is s bolical of the restored Union brought about so largely by their ge wisdom, and strength.

A subordinate idea of the bridge is to provide fit places for memo statues to the lieutenants of Lincoln and Grant who were active influential in the council chamber and the field during the civil wa

The places provided are upon the piers of the bridge on each sid the roadway, and as indicated on the blue print and tracing sent h with. These details could be modified for each pier and a pleasing riety of effect produced.

The location of the bridge is on the direct line from the Naval Obse atory to the northern gate of Arlington.

The main spans are [illegible] feet in the clear, with a clear height abo high tide of 90 feet under two of them. This is believed sufficient all purposes. Some of the largest vessels going to Georgetown wou have to lower their topmasts to pass under, but on the whole the inco venience resulting would be very much less than that from a low brid with a draw; besides, the monumental character of the bridge requir it to be continuous and precludes the adoption of a draw.

The arches are designed to be of steel specially adapted for the wor. In the drawings these are shown as segment arches. It would probabl be more desirable to adopt the elliptical form, as more graceful and mor suitable under all the circumstances. The approaches and a portion the bridge across the lowlands are designed to be in embankment 5 feet in width on top, well paved, and with sidewalks and a substantia railing. The side slopes to be 1 on 1½.

Cost of the bridge.—It is only possible to estimate approximately th cost of this bridge. To make a close estimate would require much mor elaboration of the design and much more data than are now available a to the subriver strata. The accompanying estimate is made upon data obtained from various sources and assumed according to my best judgment. According to the estimate, the cost would be $1,250,000.

This would give a bridge of great strength and solidity, of the highest excellence, and in every way a suitable structure. It does not include anything in the way of statuary, which could be added from time to time.

The plans and estimates can be modified in such ways as to provide for a bridge of the same general type at an expense not exceeding $1,000,000.

On the other hand, unknown difficulties of construction, increased ornamentation, beautification of the approaches and their vicinity, &c., might bring the cost up to $1,500,000.

In other words, the bridge will cost from $1,000,000 to $1,500,000, according to the ultimate details adopted and the difficulties of construction met with.

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deflecting the bridge from the direct line to the gate of Arlington,
t it shall cross Analostan Island proper, a saving could be effected
50,000 to $200,000.
ve the honor to request that this design may be considered as one
alternative designs asked for in Senator Sherman's resolution.
Very respectfully, your obedient servant,

THOMAS W. SYMONS,
Captain of Engineers.

CHIEF OF ENGINEERS, U. S. A.

ESTIMATE.

tment, 600,000 cubic yards, at 25 cents	$150,000
m pavement on embankment	3,500
along embankment	1,500
tment piers, each 3,000 cubic yards, at $12.50, $37,500	75,000
all piers, each 750 cubic yards, at $12.59, $9,375	46,875
annel piers, each 5,600 cubic yards, at $15, $84,000	252,000
rs, each 5,600 cubic yards, at $12.50, $70,000	140,000
rs (Analostan), each 750 cubic yards, at $12.50, $9,875	18,750
el spans, 300 feet clear, each 1,250,000 pounds, at 5 cents, $62,500	250,000
eel spans, 150 feet clear, each 300,000 pounds, at 5 cents, $15,000	105,000
span, 200 feet clear, 500,000 pounds, at 5 cents	25,000
and sidewalks	30,000
n bridge proper	6,000
rotection to embankment	6,000
lls	15,000
expenses, including engineering, surveying, painting, lighting, materials, office expenses, &c., and contingencies	125,375
al	1,250,000

OR BRIDGE ACROSS THE POTOMAC RIVER FROM OBSERVATORY HILL TO ARLINGTON.

General description.

ucture.—Bridge to be essentially a deck bridge, with two partially through
oadway to be 30 feet wide, with 8 feet sidewalks on each side. Roadway
Observatory Grounds, at an elevation of 40 feet above tide, and gain an
of 95 feet over the two center spans, then to descend at the same grade one
feet, or 2$\frac{85}{100}$ feet in 100 feet, to an elevation of 40 feet at Analostan slough,
ascend to an elevation of 60 feet at Arlington gate. Roadway to be sup-
by steel arches across the main river, Potomac Park, and a part of the low
Analostan Island.
bridge across Analostan slough; the remainder of the way and the ap-
to be in embankment.
—The four spans across main river to be 300 feet wide in the clear. The two
ans to have a clear way above tide of 90 feet, the others a clear way of 70
e seven smaller spans to be 150 feet in clear width, and of varying height,
equisite grade.
ss bridge across Analostan slough to be 200 feet span.
—To be handsome in design, of solid masonry. The ends of the piers outside
rstructure to be brought up to a height of about 8 feet above the roadway,
bed for the reception of memorial statues to the great civilians, sailors, and
active in the civil war. These statues to be added from time to time.
ial arch.—A grand memorial arch or other suitable structure to be erected
Washington end of the bridge, commemorative of Lincoln and Grant, with
eciting their great services, and the fact that this bridge across the Potomac
North to the South is erected as their most suitable monument.

APPENDIX J.

PROVEMENT OF THE HARBORS AT BRETON BAY AND SAINT JEROME'S CREEK, MARYLAND; OF THE CHANNEL AT MOUNT VERNON; OF RAP-PAHANNOCK RIVER, AND YORK RIVER, VIRGINIA; OF TRIBUTARIES OF THE LOWER POTOMAC, AND OF CERTAIN RIVERS IN VIRGINIA AND NORTH CAROLINA.

PORT OF MR. S. T. ABERT, UNITED STATES AGENT, IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

Channel at Mount Vernon, Virginia.
Sealsco Creek, Virginia.
Breton Bay, Leonardtown, Md.
Nomini Creek, Virginia.
Harbor at entrance of Saint Jerome's Creek, Maryland.
Rappahannock River, Virginia.
Totusky River, Virginia.
Urbana Creek, Virginia.
Mattaponi River, Virginia.
10. Pamunky River, Virginia.
11. York River, Virginia.
12. Chickahominy River, Virginia.
13. } Staunton River, Virginia.
14. }
15. Dan River, between Madison, N. C., and Danville, Va.
16. Roanoke River, North Carolina.
17. French Broad River, North Carolina.

EXAMINATION.

18. Aqueduct Bridge over the Potomac at Georgetown, District of Columbia.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., July 23, 1886.

GENERAL: I have the honor to submit herewith my annual report r the fiscal year ending June 30, 1886, relating to the improvement of vers and harbors under my charge.

Very respectfully, your obedient servant,

S. T. ABERT,
United States Agent.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

J 1.

IMPROVEMENT OF POTOMAC RIVER AT MOUNT VERNON, VIRGINIA.

HISTORY OF OPERATIONS.

(1) *Reference to reports.*—A history of operations will be found in the eport of the Chief of Engineers for the year 1882, page 1,003.

(2) *Description of original condition.*—The landing at the wharf was rmerly made by passing over the flat bordering the channel of the

Potomac for a distance of 1,900 feet. The least depth at that tim 4 feet at low water.

(3) *Plan of improvement.*—The proposed cut to the wharf was inte to have a width of 150 feet and a navigable depth of 6 to 7 feet, w basin at the wharf of 150 feet radius.

(4) *Results obtained.*—The channel was completed September 1, with a width of 145 feet and a depth of from 7 to 9 feet. In 188 1881, 41,384 cubic yards of material were removed at rates va from 12½ to 17 cents per cubic yard.

(5) *Operations proposed.*—No recent examination has been mad it is believed that $5,500 will be required for the purpose of enla and deepening the basin, widening the channel, and removing th which has been deposited in the cut.

The following appropriations have been made:

March 3, 1879 ....
June 14, 1880 ....
March 3, 1881 ....

Total ....

Money statement.

July 1, 1885, amount available ....
July 1, 1886, amount available ....

Amount (estimated) required for completion of existing project ....
Amount that can be profitably expended in fiscal year ending June 30, 1888
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

STATISTICS OF TRADE.

Mr. Harrison H. Dodge, superintendent, reports the trade by water as follow

Number of visitors during 1885 ....
Total value of material products (consisting of dairy products (milk), lumber, grain, sheep, lambs, calves, etc.) ....
Total value of manufactures (consisting of fertilizers, corn-meal, wagons, and carriages, etc.) ....

Total ....

There were 250 arrivals and the same number of departures of steam vessels the year, with a greatest draught of 4½ feet.

Mr. Dodge adds:

"The resources of the tributary country are likely to increase perceptibly, to a more careful and improved method in the treatment of land and stock dairy business grows steadily as the city demand increases.

"Should the facilities be improved the trade by water from this landing w nearly double the present rate.

"The channel is so narrow and shallow as to permit of boats of the very l draught only entering. With great difficulty the steamer can barely make h at the pier, oftentimes, however, narrowly escaping being stuck fast in the mu

"The roughness of this statement I trust may be overlooked, but I must s prayer that the water approach and exit at Mount Vernon may be speedily imp

"HARRISON H. DO

J 2.

IMPROVEMENT OF NEABSCO CREEK, VIRGINIA.

HISTORY OF OPERATIONS.

(1) *Reference to reports.*—The report of the survey will be found in the port of the Chief of Engineers for 1881, page 947. For history of rations, see page 1006, Report of the Chief of Engineers for the year 82, Part I.

(2) *Description of original condition.*—See Report for 1885, page 963.

(3) *Plan of improvement.*—According to the original project of improvement, the channel was to be 100 feet wide and 7 feet deep at low ater.

(4) *Amount expended and results obtained.*—The first and last appropriation was in 1881 ($5,000), which was expended in the manner exined in full in the Annual Report for 1885, pages 962, 963. Nothing ne during the year.

Should the improvement be continued, $20,000 should be appropriated for the year ending June 30, 1888.

Money statement.

ly 1, 1885, amount available	$57 27
ly 1, 1886, amount available	57 27
Amount (estimated) required for completion of existing project	20,000
Amount that can be profitably expended in fiscal year ending June 30, 1888	20,000

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

J 3.

IMPROVEMENT OF BRETON BAY, LEONARDTOWN, MARYLAND.

HISTORY OF OPERATIONS.

1) *Reference to reports.*—A history of operations will be found in the port of the Chief of Engineers for the year 1882, page 1009, and in Report for 1883, page 797.

2) *Description of original condition.*—Breton Bay enters the Potomac er 82 miles below Washington, D. C. For a distance of 3,600 feet its eral course from Leonardtown is southeast. There it changes to thwest, and terminates, at a distance of 6¼ miles from the town, at 18-foot curve in the Potomac. Its width at Leonardtown is about feet. One and a fourth miles below the width is 1,550 feet, and after her widening it contracts at the mouth to about 1 mile. Its least th is 8.8 feet near Leonardtown, which gradually increases to 18 feet he mouth. Before improvement the bar extended from Leonardtown he 9-foot curve in the bay, a distance of about 1 mile The least th on it was 5 feet at low water.

3) *Plan of improvement.*—The original project contemplated dredging hannel 150 feet wide from Leonardtown to the 9-foot curve, with a th of 9 feet at low water. A basin was to be dredged at the Leontown wharf.

4) *Amended project.*—In order to maintain the depth of water in the nnel, I would propose to widen the cut to 200 feet for a distance of miles, and to enlarge the basin to a width of 400 feet by 800 feet in gth. So far as it may be permitted I would deposit the material par-

allel with the channel, as above described. The basin and cl should not be less than 10 feet in depth.

The following are the items of the estimate:

143,000 cubic yards, at 15 cents per cubic yard	
20 per cent. for contingencies	
Total	

This work can be completed for the sum of $26,000, if approp in one year.

(5) *Results obtained.*—At the close of the work, in January, 188 channel was 115 feet wide, and not less than 8.8 feet deep. I found after examination that the basin had decreased in depth a upper end, and that the channel below the wharf had also decr in depth for a distance of 2,800 feet. The decreased depth o basin and of the channel below does not seem to have the same c The basin appears to have been filled by the wash from the creeks banks above it, while the channel below seems to have been muc jured by the injudicious management of the steamers. Both the fects may be reduced, but it seems impossible to remove the cause

No funds were available for the prosecution of the work during year ending June 30, 1886.

(6) *Amount expended.*—From the year 1879 to June 30, 1886, $22,95 have been expended in excavating 131,358 cubic yards of materia rates varying from 12 to 18 cents per cubic yard.

The following appropriations have been made:

June 18, 1878	$
March 3, 1879	
June 14, 1880	
March 3, 1881	
August 2, 1882	
July 5, 1884	
Total	2

The work is in the collection district of Annapolis, which is the nearest port try. The work is in the fifth light-house district, and the nearest light-house is istone Island Light.

Leonardtown is one of the landings of the Potomac River boats.

Money statement.

July 1, 1885, amount available	$
July 1, 1886, amount available	
Amount appropriated by act approved August 5, 1886	6,5
Amount available for fiscal year ending June 30, 1887	6,5
Amount (estimated) required for completion of existing project	19,5
Amount that can be profitably expended in fiscal year ending June 30, 1888	19,5
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

STATISTICS OF TRADE.

Mr. H. F. Moore furnished a statement of the trade at Leonardtown for 1885, ing the following totals:

Total value of natural products	$33
Total value of manufactures	33
Total	66

For detailed statement see Report for 1885.

Mr. Moore states that a corporation contemplates building a fertilizer factory also a factory for the manufacture of hats.

J 4.

IMPROVEMENT OF NOMINI CREEK, VIRGINIA.

HISTORY OF OPERATIONS.

(1) *Reference to reports.*—The report of the final survey will be found in the Report of the Chief of Engineers for 1873, page 822. The report of survey from the ferry (Nomini Wharf) to the head of tide-water, at Beale's Mill, will be found in the Report for 1881, page 954. For history of operations to June 30, 1884, see Reports from 1882 to 1884.

(2) *Description of original condition.*—For full statement of condition before improvement, see Report for 1885, page 966.

(3) *Plan of improvement.*—The improvement proposed in the original project was to dredge a channel 100 feet wide and 9 feet deep at low water from the 9-foot curve in Nomini Bay to White Oak Point, a distance of 4,400 feet. The large increase of trade which followed the opening of the new channel called for an amended project, which was submitted in 1882. The amendment consisted in the proposed widening of the main channel, and in cutting a tributary channel from Bushfield Bay (on the right) in an oblique direction to the main channel. As supplementary to this cut, the closing of the old channel from the same bay was proposed. The old side channel is objectionable for two reasons: It causes the extension of White Point, which encroaches more each year upon the main channel, and it conducts a strong ebb current, which impinges on the bows of the entering steamers and forces them into the shoal water on the opposite side. The widening of the main channel is necessary for the safe navigation of the steamers from Baltimore and Washington. The total cost of the project, original and amended, was $62,500. In the Report for 1885, $30,000 were thought to be sufficient to complete the project.

(4) *Results obtained.*—Thirty-two thousand five hundred dollars have been expended in dredging 74,874 cubic yards of sand and shells, which resulted in securing a channel about 100 feet wide and 9 feet deep from the 9-foot curve in Nomini Bay to White Oak Point, a distance of 4,400 feet. Steamers now trade where formerly only small vessels drawing about 3 feet of water could reach at high tide.

(5) *Work during the fiscal year ending June* 30, 1886.—Nothing was done during the year, the total amount of appropriations, $32,500 (from 1873 to 1882) having been expended.

(6) *Operations contemplated.*—It is proposed to complete the work according to the project submitted in 1882 and described above, namely, to widen the cut to 200 feet for a distance of 5,700 feet from the 9-foot curve in Nomini Bay to Hickory Point.

No work can be done during the year ending June 30, 1887, because no appropriation has been made for this important improvement since 1882.

(7) *Appropriations.*—Thirty-two thousand five hundred dollars have been appropriated and expended between March 3, 1873, and August 2, 1882.

The work is in the collection district of Tappahannock, which is the nearest port of entry.

Money statement.

Amount (estimated) required for completion of existing project	$30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	30,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

STATISTICS OF TRADE.

Mr. C. W. Ridley, manager of the Washington Steamboat Co
landings in Nomini Creek are the most important made by the Po
He gives the total trade by steamers of his company, compiled fr
valued at $305,566.

Mr. A. Needham, of the Potomac Transportation Line, reports
377 tons.

Mr. F. E. Tubman reports the total value of the trade by sail v

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J 5.

IMPROVEMENT OF HARBOR AT ENTRANCE OF SAINT J
MARYLAND.

HISTORY OF OPERATIONS.

(1) *Reference to reports.*—A report and estimate will
Report of the Chief of Engineers for 1881, Part I, pa
ports from 1881 to 1886 give the work done since that

(2) *Description of original condition.*—Saint Jerome's
in Saint Mary's County, Maryland, and enters Chesape
north of Point Lookout and 91 miles south of Baltimore.
two prongs or branches, a south prong and a north pr
has a depth varying from 15 feet at the mouth to 6 feet
up. The average depth in the small channel, which co
used by the Fish Commission for experiments in batch
before improvement, about half a foot at low water. A
between the 9-foot curve in the bay and Corsey's Point.
2,193 feet, and a minimum depth of 2.8 feet at low wate
low, the land level and sandy.

(3) *Plan of improvement.*—The original project conte
a continuous channel through the bar and into the so
as the "hatching pond." For convenience of descript
was divided into an outer and an inner channel, the di
at the mouth of the creek at Corsey's Point.

First. The outer channel when completed will have
of 100 feet, with a depth of 9 feet at low water. Its le
feet.

Second. The inner channel when completed will hav
of 40 feet, with a depth of 6 feet at low water. Its leng
Point to the upper wharf of the Fish Commission, near
3,742 feet.

(4) *Amount expended and results obtained.*—The cost
to June 30, 1885, was $20,289.37. The inner channel h
ing from 3.3 to 5½ feet between Deep Point and the up
Fish Commission. Its width was about 30 feet.

The outer channel at the close of the year 1884 had a
of 3.8 feet at low water. At the close of the fiscal yea
1885, it had a minimum depth of 7.9 feet at low water
feet) between the 9-foot curve and Corsey's Point. With
8 feet could be carried into the mouth of the creek.
Point to Deep Point the depth varied from 6½ to 9 fe
The work, particularly on the outer bar, has always bee

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erimental. The preservation of the depth is doubtful, for reasons which ave been stated in former reports.

(5) *Work done during the fiscal year ending June 30, 1886.*—All work n this creek is done by dredging under contract. The contract enered into on December 18, 1884, with James Caler & Son, of Norfolk, a., the lowest bidder, at 13 cents per cubic yard, was continued into he present fiscal year.

	Cubic yards.
he material dredged by Caler & Son up to June 30, 1886, amounted to	63,337
es deductions for excess over depth specified	277
et amount of dredging	63,060
mount dredged to June 30, 1885	51,954
mount dredged to August 18, 1886	11,106

(6) *Future operations.*—The outer channel has not the depth required y the project, but if it is found to be sufficient for the purposes of naviation, operations under the next appropriation may be limited to seuring in the inner channel the depth and width desired by the Fish Commission, viz, a depth, when completed, of 6 feet at low water, with width of 40 feet at bottom. To continue the excavation to these diensions will require an appropriation of $26,000.

The nearest harbors of refuge are the Patuxent River, about 15 miles o the north, and Saint Mary's River, in the Potomac, about 30 miles istant. From its situation it is evident that Saint Jerome's would ford a convenient harbor of refuge, particularly for small sailing vesels and oyster-boats, if the bar at the mouth was removed.

The following appropriations have been made:

arch 3, 1881	$6,500
gust 2, 1882	5,000
ly 5, 1884	15,000
Total	26,500

The work is in the collection district of Annapolis. The nearest light-house is oint Lookout, 6 miles distant.

STATISTICS OF TRADE.

No commercial statistics were received for the past year. Mr. G. G. Joynes furnished statement of the trade during the year 1884, showing a total value of shipments nd receipts of $167,800. (For items see Report for 1885, page 970.) There is a fishing ation at this point.

A chart of Saint Jerome's Creek, showing work during the year and the buildings nd hatching ponds of the United States Fish Commission, accompanies this report.

Money statement.

uly 1, 1885, amount available		$6,210 63
uly 1, 1886, amount expended during fiscal year, exclusive of iabilities outstanding July 1, 1885	$3,739 10	
uly 1, 1886, outstanding liabilities	40 00	
		3,779 10
uly 1, 1886, amount available		2,431 53
Amount (estimated) required for completion of existing project		26,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888		18,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

J 6.

IMPROVEMENT OF RAPPAHANNOCK RIVER, VIRGINIA.

HISTORY OF OPERATIONS.

(1) *Reference to reports.*—A summary of operations from th
mencement of the work to the close of the fiscal year ended J
1882, will be found in the Report of the Chief of Engineers for th
page 1037; also in the Report for 1883, page 802. The report
survey of Capt. Joseph F. K. Mansfield, made in 1852, will be fo
the Report of the Chief of Engineers for 1874, page 36. In the
volume, Part II, page 32, will be found the report of the survey
in 1870.

(2) *Description of original condition.*—The Rappahannock from
ericksburg, the head of navigation, to the Chesapeake Bay is
106½ miles in length, measured on the charts. It enters Chesa
Bay 119 miles below Baltimore. Its general course is southeast
width at Fredericksburg is about 300 feet, and it continues narrow,
two exceptions, namely, at Tobago Bay and Green Bay, as far as
pacia Creek, 56½ miles below Fredericksburg, where its fluvial ch
ter disappears. At this point its width is about half a mile. From
point it gradually widens in its course and becomes, at its mout
miles wide. The tides range from 2½ feet at the mouth to about 4
at Fredericksburg.

Freshets are of short duration, rising to about 20 feet at Frederi
burg, and are but slightly felt at Port Royal, 29½ miles below.
table showing highest water at Fredericksburg for each month f
1879 to 1885, also for table of distances, see Report of 1885, pages
and 972.)

(3) *Plan of improvement.*—According to the original project, the
posed cuts were to have a navigable depth of from 9 to 10 feet at
water with a width of 100 feet at bottom through all the bars.

Training-dikes were recommended for the preservation of the de
but the method of construction, position of the dikes, and estimat
cost were left for future determination.

In 1879 a general estimate was submitted which included these o
sions and also the cost of increasing the depth and width of the ch
nel. It was not practicable to fix precisely the location of the dike
the dimensions of the cuts, as the work advanced slowly, and cha
must occur before the point of improvement could be reached. The
venience of a general estimate is, however, obvious. The calculati
were based on a channel which should have a width of from 100 to
feet and a depth of 10 feet at low water as far as Port Royal, 29½ m
below Fredericksburg, and thence to the mouth the channel should
be less than 200 feet in width with a depth of not less than 15 fee
low water. The estimate included such dikes as, at the time, see
necessary. It was expressly stated that before beginning the impr
ment at any locality a careful survey and final plan should be
pared. The total cost of the work was estimated to be $291,000.

(4) *Amount expended and results obtained.*—From the adoptio
the project in 1879 to the close of the fiscal year ended June 30, 1
$65,445.31 were expended between Fredericksburg and Farley
bars (a distance of 12.6 miles) in dredging 119,061.8 cubic yards of
and silt and in the construction and repair of dikes.

The results of this expenditure up to June 30, 1885, were as follows: Between Fredericksburg and Farley Vale the channel had a depth of not less than 8.1 feet at low water, and a width of about 100 feet for 12½ miles, the distance improved.

The following table gives the results of the improvement at each of the bars, showing the depth before improvement, and the least depth in a width of 100 feet at the close of the fiscal year ended June 30, 1885:

Locality.	Depth at low water before improvement.	Least depth at low water, June 30, 1885.	Remarks.
	Feet.	*Feet.*	
edericksburg Bar	4.0	8.0	
llock's Bar	7.3	8.2	10 feet could be carried.
rnard's Bar	8.5	9.4	
ratt's Reach Bar	8.3	8.1	9 feet could be carried.
ottswood (upper) Bar	6.0	8.5	
ottswood (lower) Bar	6.0	8.3	8½ feet could be carried,.
tle's Ferry Bar	8.0	9.0	
rley Vale Bar	8.0	10.4	10 feet could be carried.

The navigable depth at high water varied from 12 to 15 feet for a distance of 12.6 miles as far as the improvement had advanced.

WORK DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

(5) *Dredging.*—The contract for dredging under the appropriation of July 5, 1884, assigned to Daniel Constantine, the lowest bidder, at 19 cents per cubic yard, approved May 5, 1885, was continued into the present fiscal year. Work was begun June 11, 1885, and the contract was completed on November 30, 1885.

	Cubic yards.
The total net excavation under this contract was	38,243.6
Amount excavated to June 30, 1885	3,867.8
Total net excavation during fiscal year ending June 30, 1886	34,375.8

Fredericksburg Bar.—The deposits in the turning-basin at the steamboat wharf were removed to a depth which at the close of the work was about 10½ feet at low water, and the extreme width 240 feet. From the basin a channel was dredged for a distance of 3,920 feet, with a width of 80 feet and a depth at low water of 10½ feet. From this point (765 feet below Hazel Run) a channel of the same depth and 40 feet wide was continued for a distance of 920 feet, and stopped at the mouth of Deep Run.

The total amount removed from this bar during the year was 19,016 cubic yards.

Spottswood Bar (upper end).—The cut began in the channel about 400 feet above Dike No. 4, and was continued to a point 450 feet below Dike No. 18, a distance of 2,965 feet. For 600 feet the channel was made 80 feet wide, and for 2,365 feet it was made 60 feet wide.

The depth at low water was 10½ feet.

The amount of dredging on the bar was 15,359 cubic yards. The total removed from both bars during the year was 34,375 cubic yards. All the material removed was deposited behind the dikes.

At Spottswood Bar 5,119 cubic yards were removed after t
of October 29, 30, and 31, 1885. This freshet deserves specia
It reached the height of 21 feet above low-water mark at F
burg, and was the highest which has occurred in ten years.

In connection with the work at Spottswood Bar the plantin
seed must be mentioned. For a distance of 1,530 feet an
feet back from the water's edge locust seed was planted, in c
strain the spread of the water and to confine the current of t
to the course of the channel. The height of the bank was be
to the growth of locust than to that of willow.

(6) *Work done by day labor.*—At Fredericksburg, Dike No
paired at a cost of $70, and strengthened at a cost of $67.

At Spottswood, upper end of bar, six mats were sunk at t
the dike at a cost of 2.9 cents per square foot.

At Farley Vale six mats were sunk at the end of the dikes a
3 cents per square foot. The damage done to the dikes a
Bar by the freshet of October, 1885, has been repaired.

SURVEYS MADE DURING THE FISCAL YEAR.

Careful surveys of the bar at Nanzatico Reach and Nay
were made in May and June, 1885. The report of the surv
zatico Reach is appended to these reports with two charts.
and charts of the bar at Naylor's Hole are not submitted.

The work required at this locality cannot be reached with
priation for this year, and the report and charts are retain
ther consideration;

(7) *Appropriations.*—The amount expended upon former p
$90,500. The following appropriations have been made for t
project:

June 14, 1880 ....
March 3, 1881 ....
August 2, 1882 ....
July 5, 1884 ....

Total ....

These appropriations were made under the following gener
for improving the river from Fredericksburg to the 15-foot
Tappahannock, a distance of 64½ miles.

(8) Estimate of 1879 ....
Amount appropriated up to June 30, 1886 ....

Amount due on estimate ....
Amount appropriated by act approved August 5, 1886 ....

Balance due on estimate ....

STATISTICS OF TRADE.

No statement of commercial statistics has been received. The Commi
merce furnished a statement for the year 1883 (see Report for 1884) show

Total trade by water and rail ....
Amount of business done by mills, factories, &c., was ....

The followings drawings accompany this report:

(1) Chart of Fredericksburg Bar.
(2) Chart of Spottswood Bar.
(3) Chart of Rappahannock River from Fredericksburg to the mouth.
(4) Chart of Rappahannock River from Fredericksburg to Farley Val
(5) Chart of Nanzatico Reach—Hydrographic map.
(6) Chart of Nanzatico Reach, showing current observations.

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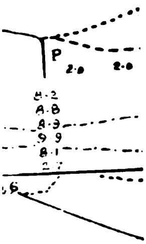

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Money statement.

1, 1885, amount available		$11,554 69
1, 1886, amount expended during fiscal year, exclusive of bilities outstanding July 1, 1885	$10,154 83	
1, 1886, outstanding liabilities	298 56	
		10,453 39
1, 1886, amount available		1,101 30
t appropriated by act approved August 5, 1886		20,000 00
t available for fiscal year ending June 30, 1887		21,101 30
nt (estimated) required for completion of existing project		194,000 00
nt that can be profitably expended in fiscal year ending June 30, 1888		90,000 00

mitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

VEY OF BAR AT NANZATICO REACH AND TOBAGO BAY, RAPPAHANNOCK RIVER, VIRGINIA.

UNITED STATES ENGINEER OFFICE.
Washington, D. C., July 23, 1886.

GENERAL: I have the honor to submit the following report of the vey of the bar at Nanzatico Reach and Tobago Bay, in the Rappahan- k River, Virginia, made between the 4th and the 23d of May, 1885: Tobago Bay is 34 miles below Fredericksburg.

The object of the survey was to ascertain the nature of the obstruc- n to navigation, and to obtain the data necessary for the determination the plan of improvement, and also for estimating the quantity of terial to be removed and the cost of the work required.

Project.—The original project for improvement at this point contem- lates securing a channel which shall, when completed, be 200 feet wide bottom and 15 feet deep at low water.

Description of the bar.—The total length of the bar, from a point in e 15 foot curve below Nanzatico to the 15-foot curve below Long Point, 5,540 feet. A narrow channel, not less than 10 feet in depth at low ater, can be carried over the bar. In the course which can be conve- ntly followed by steamers the depth is 8.3 feet at low water, which much less during the prevalence of unfavorable winds and tides. low Long Point the channel is narrow—100 feet in width for distances hich are together equal to 2,080 feet in length, and has the required pth of 15 feet at low water.

Two bays give an unusual width to the river at this locality.

Nanzatico Bay has a chord of 5,630 feet and is about the length of the r. Its versed-sine is 2,815 feet or half its chord. Tobago Bay has a ord of 6,100 feet and a versed-sine about equal to the length of its ord.

These bays are undoubtedly a remnant of the prehistoric condition the river, and to them the bar owes its existence. The least depth is und in the channel of Nanzatico Bay.

Triangulations.—A broken base line, 4,406.5 feet in length, was care- lly measured along the shore above Long Point.

The area covered by the triangles is 1½ by 2½ miles, or 3¾ square miles. The stations were marked and witnessed so that they could be identified.

Current observations.—These observations were confined mainly to the annel, and were made with the object of determining the direction

ro of this gauge was referred to a mark on Long Point, formed
l driven into a bench cut upon an elm tree, which stands at
er mark, about 350 feet above the Point. It is 3.44 feet above
r.

er bench was established at Greenlaw's Wharf, 14 feet above
plane of mean low water.

nge of tide deduced from 90 observations made between De-
1884, and March, 1885, is 1 9 feet. The range during the survey
from 20 observations is 2 feet. The highest tide observed was
the lowest was zero.

undings were reduced to mean low water.

soundings are 1 foot greater than those shown on the Coast
hart. This difference is probably due to the fact that the sound-
n the chart of the Coast Survey were referred to the zero at
ksburg. This conclusion is drawn from chart No. 523, dated
er 29, 1853, which represents this part of the river from Tappa-
to Accaceek Point.

aneous tide observations.—The height of the water surface was
l at three stations at the same instant, viz:

n No. 1, at the head of Nanzatico Reach.

n No. 2, just above Long Point, 1 mile below.

n No. 3, 150 feet below Long Point.

n No. 2 was taken as the datum.

vels taken at high water at the same instant were as follows:

	Feet.
. 1	0.037
. 2	0.000
. 3	—0.056

servations were taken on the south side of the river.

ings.—All soundings were reduced to the low water of the gauge
ust above Long Point, and the soundings upon the lines of cross-
vere taken every 10 feet along a chord.

ottom was found to be for the most part of soft mud, offering no
to dredging or pile-driving. At a point near Raccoon Island
d is found at a depth of 21 feet below low water, and at the bar
and below Long Point the substratum is composed of sand and
hich constitutes the surface.

s.—Seventeen borings were taken in the channel and along the
sites of the dikes. The material composing the bar is soft mud,
ng greater consistence at the surface. It is penetrated without
to 16 feet below low water. Opposite Long Point, a stratum of
ravel and hard sand makes penetration more difficult. Borings
e lines C–K and D–F, taken with a view to determine the proba-
tration of piles passed through very soft mud, and penetrated
e to depths varying from 18 to 23 feet, or from 20 to 30 feet be-
water.

Raccoon Island the boring-rod penetrated sand which is much
han that above the island. These borings, indicated upon the
circlets and Roman numerals, are given in a tabulated form

Table of borings taken at Nanzatico Reach, Rappahannock River, Virginia

No. of boring.	Position of boring.	Depth of water.	Penetration in bottom.	Penetration below low water.	Difficulty of penetration.	Kind of material.	
		Feet.	*Feet.*	*Feet.*			
I	Channel, upper end of bar	12	6	18	None	Mud	
II	Channel, middle of bar	10	6	16	...do	...do	
III	Channel, lower end of bar	10	6	16	...do	.. do	
IV	Line C-K, 500 feet from C	3	20	23	...do	...do	
V	Line C-K, 1,000 feet from C	......	19	......	...do	Stiff mud	
VI	Line C-K, 1,500 feet from C	5½	21½	27	...do	...do	
VII	Line C-K, 2,000 feet from C	7	22	29	...do	...do	
VIII	Line C-K, 2,500 feet from C	9	17	26	...do	.. do	
IX	Line C-K, 3,000 feet from C	9	20	29	...do	...do	
X	Line C-K, 1,000 feet from K	2½	19½	22	...do	.. do	
XI	Line C-K, 500 feet from K	2½	19½	22	...do	.. do	
XII	Line D-E, at station D	4	19	23	... do	...do	
XIII	Line D-E, 500 feet from D	5	18	23	.. do	.. do	
XIV	Line D-E, 1,000 feet from D	3	23	26	...do	21 feet mud, 2 feet sand below.	O l a
VX	Line D-E, 1,500 feet from D	4	19	23	...do	Mud and sand	O l
XVI	Line D-E, 2,000 feet from D	4	19	23	...do	...do	B
XVII	Channel line 50–53, 100 feet from .53	14½	3½	18	Very great	Coarse gravel	O

Freshets.—The freshets which reach an elevation of from 21 t at Fredericksburg are reduced to one-third this height when th Nanzatico. The greatest elevation, according to Mr. Peyton which has been observed at Greenlaw's Wharf, 35½ miles bel ericksburg, was 7.3 feet above zero, or about 5 feet above ordin water.

Dumping-ground.—There seems to be no convenient water spa can be used by deep-draught dumping-scows, and the numbe ing stations on the shore of Tobago Bay will make the sele dumping ground for shallow dumpers a matter of some difficult dumpers, drawing 5½ feet water when loaded, may be employe lower part of the bay at extreme high water, but the extent o which can be occupied is small. The dredged material may ciously used in building a low-water dike parallel with the cha about 1,000 feet (or less) distant from it, and can be deposited the 6th and 8th foot-curves. It may be necessary to protect t from erosion by means of mattresses or sheet-piles. Dumping be permitted in the swash channel below Long Point, unless current is insufficient to remove the material.

Results of the survey.—The object of the work so far acco has been to obtain, with as little cost as possible, a knowledg nature of the obstruction and sufficient data for a general est the cost of an improvement necessary to give a channel with when completed, of 200 feet at bottom and a depth not less feet at low water.

Causes which have concurred in forming the bar.—The bar is t of several causes, the chief of which is the sudden expansio river upon the left in Nanzatico Bay and upon the right in Tob which expansions occur at a point where the river has lost mu rial character at ordinary stages. To this primary cause are d eral co-operant effects, which may be named in the following

(1) The ebb and flood tides following the trend of the bays fl ifferent paths and with different velocities, the ebb tide taking anzatico side, and the flood tide taking the Tobago side of the channel.

(2) At the turn of the tide and in the vicinity of the bar, the ebb urrent continues to run down on the north side of the channel for at ast one hour after the flood tide begins to run up on the south side of e channel. Between these two currents slackwater intervenes.

3. The upward current continues for two hours in the channel after igh water is indicated upon the gauge (No. 2) at Long Point; and e ebb current continues in the channel after the period of low water d during the rising of the water at the same gauge.

(4) The flood tide lasts 5½ hours; the ebb tide lasts 6¾ hours.

(5) The maximum velocity of the ebb is .99 miles per hour; the max- um velocity of flood is 1.02 miles per hour.

The flood has the greatest velocity; the ebb has the longest endurance. ese forces are modified by the winds.

(6) The highest freshet observed at 1½ miles below Tobago was 5 feet ove ordinary high water.

ESTIMATE.

The channel to be dredged is about 6,000 feet in length, 200 feet wide, d 15 feet deep at low water.

The amount of dredging will be 200,000 cubic yards; dike on the north side of the nnel for 4,000 linear feet; dike on the south side of the channel for 2,600 linear t. Total length of dikes, 6,600 linear feet.

The dikes should reach to half-tide. That on the north side should first constructed. The dike on the south side can be completed as as observation proves it to be necessary, for the preservation of the pth. The space behind the dikes will afford a suitable area for dump- the material dredged from the channel.

It is probable that the improvement will cost 33 per cent. more than e estimate submitted in 1879, on account of the reduction of the time labor to eight hours per day instead of twelve hours, as was then e rule.

The survey was skillfully conducted by Mr. L. R. Grabill, assistant gineer, whose map is herewith submitted.

Very respectfully, your obedient servant,

S. T. ABERT,
United States Agent.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

J 7.

IMPROVEMENT OF TOTUSKY RIVER, VIRGINIA.

HISTORY OF OPERATIONS.

Reference to reports.—A report of a survey, made March 3, 1875, e found in the Report of the Chief of Engineers for 1881, Part I, 964.

Description of original condition.—The Totusky is an affluent of the pahannock, into which it empties 35 miles above its mouth. It is

(5) *Future operations.*—The appropriation of August 2, 1882 small for economical work, and was retained until further appı should be made.

The following appropriations have been made:

June 14, 1880 ....
March 3, 1881 ....
August 2, 1882 ....

Total ....

The work is in the collection district of Richmond, which is the nearest ı try. The nearest light-house is Bell Rock.

STATISTICS OF TRADE.

No complete statistical statement was received for the year 1 Mr. Willeroy reports that the natural products were below the on account of the drought in the fall of 1884. The total trade i reported by Mr. J. S. Neale, was $9,000,000.

Mr. Willeroy reports that the greatest need is the removal oi of vessels sunk during the war, which makes navigation dangerc that trees have been blown down and become embedded in the so that they have only 3 feet of water at high tide.

Money statement.

July 1, 1885, amount available ....
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885 ....

July 1, 1886, amount available ....
Amount appropriated by act approved August 5, 1886 ....

Amount available for fiscal year ending June 30, 1887 ....

Amount (estimated) required for completion of existing project ....
Amount that can be profitably expended in fiscal year ending June 30, 1888
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

J II.

IMPROVEMENT OF YORK RIVER, VIRGINIA.

HISTORY OF OPERATIONS.

(1) *Reference to reports.*—A report of the survey of the bars a Point, Va., and off Potopotank Creek, will be found in the Repo Chief of Engineers for 1880, page 897. Work done since that c be found in subsequent Annual Reports.

(2) *Description of original condition.*—The Pamunky and Ma unite at West Point in forming the York River. The latter t lows a southeasterly direction for a distance of 41 miles, when it into Chesapeake Bay, about 16 miles in a line north of Fortre roe. Its course from West Point is noticeably straight for 3 Its average width, as far as Yorktown, a distance of 26 mil miles. Before improvement, navigation was obstructed by tv one at West Point, about 2.1 miles in length, the other at Pot Creek, about 2,200 feet in length. The depth at West Point

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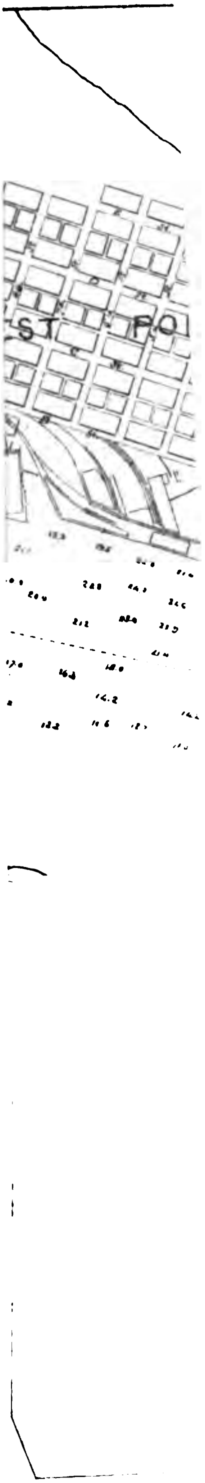
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s 15½ feet; the depth at Potopotank Creek was 18½ feet at low
Vith the exception of these two bars the depth in the channel
ess than 20 feet at low water.

n of improvement.—Three estimates have been submitted; the
ted is for dredging a channel 400 feet wide and 22 feet deep at
r.

timate amounted to $256,000.

ount expended and results obtained.—Up to June 30, 1885,
l were expended in dredging 403,429 cubic yards of material.
opotank Creek 58,809 cubic yards of material were dredged in
1881, at the rate of 15 cents per cubic yard, which gave a chan-
eet wide and 22 feet deep at low water. At West Point 344,620
rds were dredged from October 4, 1881, to June 30, 1885, at
ying from 8½ to 16 cents, which gave a channel with an average
150 feet and a least depth of 17½ feet.

ork done during the fiscal year ending June 30, 1886.—This work
e by dredging under contract. The contract with Thomas P.
approved December 6, 1884, was completed on November 23,
rom June 30, 1885, to the completion of the contract 87,421 cu-
s were removed at 8¼ cents per cubic yard. The total dredg-
r this contract was 163,338 cubic yards.

mping-ground extended from below Goff's Point to 1,200 feet
lder's Creek. The depth of the water upon the ground before
rial was deposited varied from 3 to 7.5 feet at low water. An
tion was made in June, 1886, of the movements of the currents
d flood, in order to determine the relation which they bear to
its observed near the confluence of the Mattaponi and Pa-
ivers and at the lower end of the new channel. The upper of
osits is near Buoy No. 17, about 5,400 feet below the steam-
ing at West Point, and the lower deposit is at the turn of the
near Buoy No. 13, about 10,100 feet below the same landing.
r examination should be made of the effect of the Mattaponi
unky rivers when loaded with sediment.

examinations can be conducted during the progress of the
d, when completed, will supply the data for determining the
hod to be adopted to remove or diminish the deposit in the

tion of the question can be reached at an early day if the chan-
omptly completed with the width and depth mentioned in the

llowing appropriations have been made:

1880	$10,000
1881	25,000
, 1882	25,000
884	20,000
tal	80,000
estimate	256,000
appropriated	80,000
e on estimate	176,000
mount appropriated by act approved August 5, 1886	18,750
lance due on estimate	157,250

ork is in the collection district of Richmond, Va., which is the nearest port
The nearest light-house is Bell Rock, in the fifth light-house district.

art of the bar at West Point, Va., accompanies this report.

Money statement.

July 1, 1885, amount available		$
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$10,764 69	
July 1, 1886, outstanding liabilities	82 61	
July 1, 1886, amount available		
Amount appropriated by act approved August 5, 1886		1
Amount available for fiscal year ending June 30, 1887		$
Amount (estimated) required for completion of existing project		15
Amount that can be profitably expended in fiscal year ending June 30, 1888		9

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

STATISTICS OF TRADE.

No statement of trade has been received for the year 1885. The totals of v probably slightly greater than those stated in the Report for 1884, of which lowing is a summary.

	Trade by water.	Trade
Natural products	$17,015,828	$
Manufactures	10,269,700	

	Capital.	An busines
Mills, factories, business houses, &c	$270,500	

Vessels engaged in trade during 1884.

	Number.	Total tons.
Steam	494	454,400
Sail	214	85,600
Total	708	540,000

The above summary of report of statistics, furnished by Mr. E. Wilkinson, the trade of the Piedmont Air-Line Railroad, centering at West Point, its te and also cord-wood, railroad-ties, and sumac shipped from the Mattaponi and P rivers.

J 12.

IMPROVEMENT OF CHICKAHOMINY RIVER, VIRGINIA.

HISTORY OF OPERATIONS.

(1) *Reference to reports.*—The report of a personal examinatio an estimate for improvement, will be found in the Report of the of Engineers for 1875, Part II, page 170.

An estimate for improving the bar at the mouth was submit 1882. (See Report for 1882, page 1041.)

(2) *Description of original condition.*—The Chickahominy Rive in Henrico County, Virginia, 12 miles northwest of Richmond

ast, and empties into the James River 40 miles from the mouth,
ar Newport News. Its length from Forge Bridges to the James
ut 44 miles. Between Forge Bridges and Windsor Shades the
tion is confined to lighters, and the chief obstruction at the time
vey consisted of snags and logs. At Windsor Shades, 19 miles
Forge Bridges, the depth was 4.5 feet. At Old-Fort Bar it was
5 feet, and at Binn's Bar, 22 miles from Forge Bridges, the depth
water was 4 feet. Thence no obstruction is encountered until the
the mouth is reached.

r this bar 11 or 12 feet could be carried at low water in the year

depth is influenced by the wind.

table of distances, see Report for 1885.)

Plan of improvement.—It was proposed to improve the river for 19
etween Forge Bridges and Windsor Shades by removing the logs,
and snags, and subsequently, if required by increase of trade, to
a channel through the bars. No estimate was submitted for
rt of the improvement. It was also proposed to cut a channel
h the bars at Windsor Shades, Old Fort, and Binn's, with a width
feet and a depth of 8 feet at low water. The improvement was
nade at the mouth of the river by cutting a channel through the
th a width of 200 feet and a depth of 15 feet.

Amount expended and results obtained.—Ten thousand dollars
een expended at Windsor Shades, Old Fort, and Binn's bars, and
at the mouth; making a total of $15,000.

h this sum 45,197 cubic yards of material were removed from
or Shades, Old Fort, and Binn's bars, at an average rate of about
nts per yard, and 19,859 cubic yards were removed from the bar
mouth at 22½ cents per cubic yard.

Windsor Shades the cut was made with a width of 100 feet and a
of from 8 to 9 feet at low water. At Old Fort Bar a cut was
d to a width of 100 feet and a depth of from 8 to 9½ feet; but
ng at the side the width has since been reduced to 75 feet. At
Bar the original width of cut was 200 feet, but subsequently was
d by the caving of the sides of the cut to 160 feet. The depth is
to 8½ feet at low water. A cut was made through the bar at
uth, with a width of 90 feet, a depth of 14 feet, and a length of
eet. No work has been done since 1883.

Future operations.—The cut at the mouth should be made 200 feet
s originally projected, and the channel through the bar above
have the dimensions proposed.

mate for the bars in the river amounted to	$11,000
mate for the bar at the mouth amounted to	18,000
tal	29,000
appropriated to June 30, 1886	15,000
lance due on estimate	14,000
appropriated by act approved August 5, 1886	4,000
lance due on estimate	10,000

ollowing appropriations have been made:

1878	$5,000
, 1879	1,000
1880	2,000
, 1881	2,000
, 1882	5,000
nount *appropriated to June 30, 1886*	15,000

The work is in the collection district of Richmond, which is the neai entry. The nearest light-house is Deep Water Shoal light-house, in the house district.

Money statement.

Amount appropriated by act approved August 5, 1886..................
Amount (estimated) required for completion of existing project.........
Amount that can be profitably expended in fiscal year ending June 30, 188
Submitted in compliance with requirements of section 2 of river and harb
acts of 1866 and 1867.

STATISTICS OF TRADE.

Mr. C. Perkins reports the number of steamers engaged in trade, 2; wit draught, 5 feet; sail vessels, 50; with greatest draught, 12½ feet. Total valı ments and receipts, $460,000.

Mr. Perkins adds: "The principal trade is in wood, ties, and lumber. T arriving here have difficulty in crossing the bar just below Binn's Wharf, an just above Osborne's. I would advise the deepening of these points to 12 fee

NOTE.—The depths given above probably refer to high water.

J 13.

IMPROVEMENT OF STAUNTON RIVER, VIRGINIA, BETWEEN RAI STATION AND BROOK NEAL.

HISTORY OF OPERATIONS.

(1) *Reference to reports.*—A report of an examination of the St River, between Randolph Station (formerly Roanoke) and Broo will be found in the Report of the Chief of Engineers for 1879, p 622. A report of a survey and estimates will be found in the Re 1880, p. 780. For history of operations since that date see sub Annual Reports.

(2). *Original condition.*—The principal source of the Staunto far from the Peaks of Otter, in Bedford County, Virginia. Its l about 200 miles. It unites at Clarksville with the Dan River, stream thus formed is called the Roanoke.

The part of the river under consideration, between Randolph on the Richmond and Danville Railroad, and Brook Neal, is ab miles in length. (For further description see Report for 1885, pa and 990.)

(3) *Plan of improvement.*—According to the original plan, it w posed to employ spur-dikes and rock excavation to make a char less than 35 feet wide and 2 feet deep at low water. The e amounted to $68,700.

(4) *Amount expended and results obtained to June* 30, 1885.—The expended to June 30, 1885, was $25,069. This expenditure has r in making about 18 miles of the river navigable for small steam

(5) *Work during the fiscal year ending June* 30, 1886.—Active tions began July 7 and closed August 31, 1885, when the overs transferred to the Dan River improvement. A channel 35 feet bottom and 2 feet deep at low water was cut through the following Britton's, Wesley's, Dennis's, Rice's, Michael's, and Bruce's. cavation through Kirkpatrick Shoal (23½ miles above Randol

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eted as far as Slide Rock, where work should be resumed next
. A small amount of work was left undone at the foot of Bruce s
.

en hundred and fifty-seven cubic yards of rock were removed from
annel.

m the beginning of operations in 1880 a channel has been cut
gh the bar between Randolph and Kirkpatrick Shoal (23½ miles),
bottom width of 35 feet, and a depth of 2 feet at low water.

mean level of the water surface during six or seven months is
2 to 3 feet above low water, which gives a depth during this pe-
from 4 to 5 feet.

the distance of 3 miles above Randolph the improvement is made
ng-dams, and for 20½ miles the improvement has been made by rock
ation.

m the present condition of the channel it is believed that dams
ot be needed at many of the localities, which, at the time of sur-
eemed to require their assistance in order to preserve the depth.
urvey will be necessary before the question can be finally decided.

ring the year ending June 30, 1886, a steamer has been constructed
between Randolph and Brook Neal, and has made several suc-
al trips. The plant is in fair condition, and is moored at Cole's
, under a competent watchman.

Remarks.—The season for working in the river commences on June
closes November 1. (For further remarks see Report for 1885,
990.)

profile of the Staunton River, from Brook Neal to Roanoke Station,
ng work completed up to end of fiscal year, June 30, 1886, accom-
this report.

following appropriations have been made:

3, 1879		$5,000
4, 1880		7,500
1881		5,000
2, 1882		5,000
, 1884		5,000
Appropriations to June 30, 1886		27,500
estimate		68,700
rations to June 30, 1886	$27,500	
approved August 5, 1886	5,000	
		32,500
t due on estimate		36,200

Money statement.

, 1885, amount available		$2,431 00
, 1886, amount expended during fiscal year, exclusive of lities outstanding July 1, 1885	$1,695 38	
, 1886, outstanding liabilities	30 00	
		1,725 38
, 1886, amount available		705 62
t appropriated by act approved August 5, 1886		5,000 00
t available for fiscal year ending June 30, 1887		5,705 62
unt (estimated) required for completion of existing project		36,200 00
unt that can be profitably expended in fiscal year ending June 30, 1888		20,000 00

mitted in compliance with requirements of section 2 of river and
rbor acts of 1866 and 1867.

STATISTICS OF TRADE.

Mr. Bruce writes, in response to a request for statistics of trade:

“While I am unable to give you accurate information which could be r to the trade of the Staunton, I will state that a stern-wheel steamer 85 fe run on the river, is now nearly completed, and no stronger evidence co nished of our faith in the future trade of our river or of the great benefit Government has conferred on us by improving its navigation.

“CHARLES

The following letter was subsequently received:

“I have made several successful trips with our steamer Jean up the Staun I find that your plans and work have been a success to improve the r steamer. This gives great relief to a large section of Virginia, as along th River is one of the best sections of the State, and the people have been c any outlet.

“You failed to stake off the channel you made, and until it is done make any time with the steamer, as the channels cross the river so often, on both sides in some places. When the water is over them we cannot al in, and there is danger of running on the walls, as they are sharp rocks, an cut in the boat.

“If you will send and have the channel staked off, I will furnish the stea men, and help them all I can. It will not take more than ten days, as one walls will do, as we could always see one side and know that the channe wide. My plan for staking it off would be to take a rod of iron 1 inch (in and 4 feet long, drill a hole 2 feet deep on the side of the wall, and leave t 2 feet, with a 2-inch head on the end. The boat will run in 2 feet of water, the water is over the iron rods we could run over the walls; the rods being above the water; in high water nothing will hurt them, but, of course, my idea.

“As I do not know what plan for staking off the channel will be best, wish to dictate any, I will do all I can to help in any plan you may think

“I hope you will give this important matter your attention.

“I have no doubt that Congress will give you $10,000 for work on the rive

“Please send me a map of the river.

“Yours, very respectfully,

“A. J. T

J 14.

IMPROVEMENT OF STAUNTON RIVER, VIRGINIA, BETWEEN BRO AND PIG RIVER.

HISTORY OF OPERATIONS.

(1) *Reference to reports.*—A report of a reconnaissance and e of the part of the Staunton which lies between Brook Neal River will be found in the Report of the Chief of Engineers page 1047. A more careful examination of the part of the Sta tween Pig River and the bridge of the Virginia Midland Rail be found in the Report for 1883, page 827.

(2) *Description of original condition.*—The distance from Pig Brook Neal is about 52 miles; the descent is 221 feet, and the fall per mile 4.3 feet. Between these points the width varies fr 350 feet. The valley through which it flows is from ½ to 1 mil

The least depth on the shoals is about four-tenths of a fo water, but the river is navigated by batteaus in ordinary sta bottom of the river is, for the most part, of solid rock, and th bars, which are occasionally found, no doubt rest on rocky be

Freshets rise to the height of from 20 to 30 feet.

(3) *Plan of improvement.*—The object proposed by the improve to remove the obstacles to batteau navigation by employing sp chiefly to reduce the slope of the water above, and by excava

om the channel with the object of gaining depth as well as of reducing e slope.

The estimate for improving the river between Pig River and the rail- d bridge, about 23¼ miles, is $34,000.

The estimate for improving that part of the river between the rail- d bridge and Brook Neal was based upon a reconnaissance made ithout instruments, and should be revised after a careful instrumental rvey.

The width of the proposed channel above the railroad bridge is 14 t, with a depth of 2 feet at low water.

(4) *Amount expended and results obtained.*—Two thousand dollars, ap- priated August 2, 1882, were expended in making a cut through the ks at Clement's Falls, just above the railroad bridge, and at Brown d Tuck's shoals, which are between 7 and 8 miles below Pig River.

The channel at Clement's Falls is now 20 feet wide and 1½ feet deep low water. At Brown and Tuck's shoals the channel is now about 14 t wide and 1¼ feet deep at low water.

These operations extended over a distance of about 15 miles.

The total number of yards of rock removed is 535, at a cost of $2.80 r cubic yard.

Money statement.

y 1, 1885, amount available	$105 21
y 1, 1886, amount available	105 21
ount appropriated by act approved August 5, 1886	5,000 00
ount available for fiscal year ending June 30, 1887	5,105 21
Amount (stimated) required for completion of existing project	27,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	27,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

J 15.

IMPROVEMENT OF DAN RIVER, VIRGINIA AND NORTH CAROLINA.

HISTORY OF OPERATIONS.

(1) *Reference to reports.*—The report of a survey from Danbury, N. C., to Danville, Va., will be found in the Report of the Chief of Engineers for 1879, Part I, page 652, and in the Report for 1880, Part I, page 788.

The Report of the survey from Danville to Clarksville will be found in the Report for 1880, page 794. A history of operations up to June 30, 1882, will be found in the Report for that year.

In the Report for each of the succeeding years will be found the history of operations since that date.

(2) *History of original condition.*—The Dan River rises near Buffalo Knob, in Patrick County, Virginia. From Danbury to Danville the distance is a little more than 78 miles; dividing this distance into two sections at Madison, the distance from Danbury to Madison is 28.39 miles, and the descent 10.24 feet per mile, a rate of descent not to be overcome for purposes of navigation, except by means of locks and dams. From Madison to Danville the distance is 49.81 miles, and the average descent 2.82 feet per mile, a rate of descent which makes improvement possible by means of spur-dikes and rock excavation. Im-

provement by this means is practicable, since the des centrated at a few localities.

(3) *Plan of improvement.*—The channel now being ex teaux is 16 feet in width, and 2 feet in depth at low wate

(4) *Amount expended and results obtained up to June* 30, 1 eight thousand one hundred and eleven dollars and ni were expended on the improvement of 5¼ miles (nearly) of Danville.

(5) *Work done during the fiscal year ending June* 30, 18 dred and twenty-five cubic yards of rock were removed nel.

Dam No. 1, at Long Wall, was extended 160 feet, and the lower end of Bull Sluice, was extended 103 feet.

The plant has been moored, and the property belonging Broad River, North Carolina, has been stored at Wilson' the charge of a watchman.

A resurvey was made of seven shoals at the following l

No.	Designation.
I.	Slink's Shoal
II.	Three Island Shoal
III.	Eagle Falls
IV.	Galloway's Ford
V.	Tan Yard Shoal
VI.	Cow Ford Shoal
VII.	Ware's Shoal

From the beginning of the improvement up to June 30, nel has been cut through all the bars between Danville Ferry (5¼ miles) with a width of 16 feet and a depth of 1 water. To complete this part of the improvement acco original design Dam No. 1 at the head of Long Wall s tended 120 feet. Sufficient rock has been quarried for thi

(6) *Future operations.*—When active operations are re should commence at Glass and Butter Spring shoals, bet miles above Danville.

These shoals constitute the next serious obstruction en ascending the river.

(7) *Remarks.*—The season for working in the river co June 1 and closes on November 1. (For further remark for 1885, page 995.)

The following appropriations have been made:

June 14, 1880 ....
March 3, 1881 ....
August 2, 1882 ....
July 5, 1884 ....

Amount appropriated to June 30, 1886 ....

The estimate amounted to ....
Amount appropriated to June 30, 1886 ....
Amount appropriated by act approved August 5, 1886:
Improving Dan River, Virginia ....
Improving Dan River, North Carolina ....

Amount due on estimate ....

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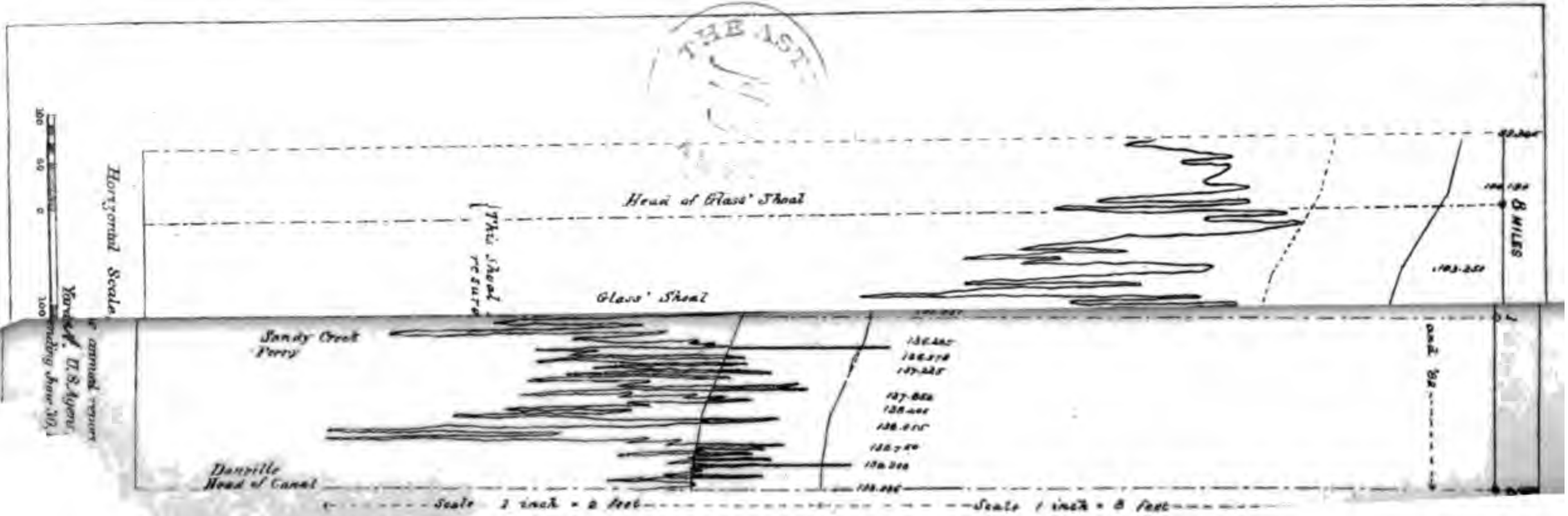

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Yard, U.S. Agent,

nding June 30,

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ofile of the Dan River, from Danville to the head of Long Shoal, g work completed up to end of fiscal year ending June 30, 1886, anies this report.

Money statement.

85, amount available		$2,388 01
86, amount expended during fiscal year, exclusive of ies outstanding July 1, 1885	$1,699 86	
86, outstanding liabilities	40 00	
		1,739 86
86, amount available		648 15
appropriated by act approved August 5, 1886		20,000 00
available for fiscal year ending June 30, 1887		20,648 15
t (estimated) required for completion of existing project		5,000 00
t that can be profitably expended in fiscal year ending June 30, 1888		1,500 00

tted in compliance with requirements of section 2 of river and or acts of 1866 and 1867.

STATISTICS OF TRADE.

onse to a request for commercial statistics, Dr. Thomas L. Sydnor, of Dan-, writes as follows:

Dan River improvement has not yet extended far enough above Danville to the trade. Nearly all the receipts during the past year have been wood. e improvement shall have extended 10 or 15 miles further, there will be large section of country which has no convenient railroad depot, and will Danville immense supplies of wood and sawed lumber, receiving in return several hundred tons of guano. A large supply of guano was held in this the spring for this section, but obstructions in the river prevented the from going up. A small steam tug is now on the stocks, and will be launched s the channel is opened a few miles further."

J 16.

EMENT OF ROANOKE RIVER, NORTH CAROLINA, BELOW WELDON.

HISTORY OF OPERATIONS.

eference to reports.—An estimate for improving the river between th and Weldon will be found in the Report of the Chief of En- for the year 1872, page 726. In the Report of the Chief of En- for 1879, Part I, page 624, will be found a summary of operations s to this time. Subsequent reports will be found for each year. port of a survey made in 1883 will be found in the Annual Report Chief of Engineers for 1884, page 1022.

Description of original condition.—The Roanoke is formed by the nce of the Dan and Staunton rivers at Clarksville, Va.; thence ldon the distance is 68¾ miles.

n Weldon to the mouth of the Roanoke at Albemarle Sound the ce is 129½ miles. The general course of this part of the river is ast. Steamboats occasionally reach Weldon at high water, but mia, 25 miles below, is regarded as the head of light-draught (3½ low water) steam navigation.

further remarks see Report for 1885, page 996.)

(3) *Plan of improvement.*—In the report of 1872 it was p
To remove the wrecks, logs, trees, snags, and dangerous
construct longitudinal dikes at all the sand-bars.

For maintaining a channel 5 feet deep at low water, the
timated at $269,000. For maintaining a channel 8 feet
water, the cost was estimated at $519,000. This expendi
recommended. In the report of 1884 the improvement
Little Rocky bars was recommended after the removal of s
are brought down each year by the Dan and Staunton rive

The present project is limited to the removal of snags, a
ful survey for the purpose of determining the best method o
some of the bars, particularly Big and Little Rocky bars.
required for building the plant for removing snags and l
surveying Big and Little Rocky bars is $20,000. An exp
the removal of snags should be made when needed. The t
river is very important, and the small amount of money e
removing snags will be a great benefit to navigation.

(4) *Amount expended and results obtained.*—Between March
June, 1874, $45,000 were expended in removing rocks, snag
wrecks. After a suspension of nine years, an appropriatio
was made August 2, 1882, which was expended in complet
provement of Indian Highland Bar. This work has prove
isfactory.

The appropriation of $3,000, made July 5, 1884, was ret
further appropriations should be made, the sum being regar
small for economical work.

(5) *Work done during the fiscal year ending June* 30, 1886.-
has been done during the year.

Money statement.

July 1, 1885, amount available ....

July 1, 1886, amount available ....
Amount appropriated by act approved August 5, 1886 ....

Amount available for fiscal year ending June 30, 1887..................

Amount (estimated) required for completion of existing project.......
Amount that can be profitably expended in fiscal year ending June 30, 188
Submitted in compliance with requirements of section 2 of river an
harbor acts of 1866 and 1867.

STATISTICS OF TRADE.

The following letter was received from Capt. A. M. Walker, of North
reply to a request for statistics:

"In reply to yours of the 26th ultimo (February, 1886), I would respectf
Capt. E. R. Latham as a suitable person to undertake the service. If
dress a letter, with forms, &c., to him in my care, I will attend to its pro
and may be able to assist him to some extent in the work.

"I am thoroughly satisfied that after the bars and snags have once be
a suitable snag-boat, judiciously managed, say every alternate year
amply sufficient to keep the navigation in good condition. The steadil
trade to and from the Roanoke River should at least be a warranty to
ment for such an appropriation."

R. Latham, master steamer Meteor, R. N. and B. S. B. Co., furnished the statement:

Articles.	Total value.	Articles.	Total value.
atural products.		*Manufactures.*	
and other cattle	$511,000	Agricultural machines and implements	$30,000
	10,000	Corn meal	5,000
	2,500,000	Drugs and chemicals	25,000
icts, eggs, and poultry	62,000	Fertilizers	300,000
sters	35,000	Flour	300,000
furs	6,000	Furniture	25,000
	30,000	Groceries	300,000
mules	25,000	Hardware	25,000
	75,000	Leather	5,000
	25,000	Liquors	200,000
dg; and scrap)	11,000	Mill machinery	25,000
	40,000		
	25,000	Machinery (other than agricultural and mill)	25,000
eas, beans, peanuts, &c	45,000	Mill feed	5,000
es	5,000	Wagons, carriages, &c	50,000
barrel timber	25,000	Woven fabrics	500,000
	25,000		
	1,000	Total	1,820,000
l	10,000		
	3,466,000		

nber of vessels engaged in trade is 35, with a greatest draught of 7½ feet. s for the last year has been dull, on account of the small crop and low prices

ng else can be done toward the improvement of the Roanoke River, I would e cutting off of the overhanging trees, which cause a vast deal of damage amers plying up and down.

ing up of the snags and logs would also greatly add to the improvement.

E. R. LATHAM.

TH, N. C., *April 12, 1886.*

J 17.

IMPROVING FRENCH BROAD RIVER, NORTH CAROLINA.

HISTORY OF OPERATIONS.

eference to reports.—A report and estimate for improving the the river between Brevard and Big Buck Shoals, in Buncombe nderson counties, North Carolina, will be found in the Report Chief of Engineers for 1878, page 525.

stimate for improving the part of the river between Smith's and the foot of Long Shoal, made in accordance with the act ust 2, 1882, will be found in the Report of the Chief of Engineers , page 832.

story of operations, showing the progress of the improvement 78, will be found in the Annual Reports of each year.

reports of 1882 and 1883 give condensed statements of opera-

escription of original condition.—Th Ferench Broad River rises esar's Head, a spur of the Balsam Mountain, in Transylvania , North Carolina. The general course of the part of the river

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value of the cotton crop in 1883, as reported by Capt. A. M. Walker, was 00.

now under consideration, as far as Asheville, is northeast. description see Report for 1885, page 997.)

The total distance from Wilson's Fish Trap to Smith's Br line of survey is 48.35 miles. The total descent from Wi Trap is 130.94 feet.

(3) *Plan of improvement.*—The first appropriations were the improvement of the river between Brevard and Big B After the removal of the logs and trees it was proposed t spur-dikes, and to excavate a channel through the ledges of formed the bars. Under the act of August 2, 1882, ap $5,000, the same method of improvement was extended Shoal to Smith's Bridge. The two projects were identical in eral features, and contemplated making channels 35 feet wi feet deep at low water between Brevard and Big Buck shoa feet wide and 2½ feet deep from Smith's Bridge to Long Shoa

The cost of improvement from Wilson's Fish-trap to Big Buck shoals wa estimated at	
The cost from Long Shoal to Smith's Bridge was estimated at	
Total	

(4) *Amount expended and results obtained to June* 30, 18

Aggregate of estimates		
Expended above Big Buck Shoals	$38,000	
Expended below Long Shoal	5,000	
Due on estimates		

Of this sum about $8,000 is due on the estimate for the pa river above Big Buck shoals, and $71,000 for the part of the tween Long Shoal and Smith's Bridge.

About 26 miles of the river between Brevard and Big Buck and 4½ miles above Smith's Bridge have been improved, makin of 30½ miles of improved channel.

The work will be continued above or below Big Buck Shoals be directed by Congress.

The appropriation should be divided as follows:

From Brevard to Big Buck shoals	
From the foot of Long Shoal to Smith's Bridge	
Appropriation needed for the year ending June 30, 1888	

Money statement.

July 1, 1885, amount available	
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	
July 1, 1886, amount available	
Amount (estimated) required for completion of existing project	7
Amount that can be profitably expended in fiscal year ending June 30, 1888	4

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

J 18.

EXAMINATION OF THE AQUEDUCT BRIDGE ACROSS THE POTOMAC RIVER AT GEORGETOWN, DISTRICT OF COLUMBIA.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., May 4, 1886.

GENERAL: I have the honor to submit my report of an examination the Aqueduct Bridge over the Potomac River at Georgetown, D. C., de in obedience to the order of the Chief of Engineers, dated Febary 26, 1886, and in compliance with a resolution of the Senate, which as follows:

> IN THE SENATE OF THE UNITED STATES,
> *February* 25, 1886.
>
> *Resolved*, That the Secretary of War be directed to cause to be made a careful amination of the Aqueduct Bridge at Georgetown, and report its present condition, ecially as to its safety for ordinary travel when the aqueduct is filled with water.
>
> Attest:
>
> ANSON G. MCCOOK.
> *Secretary.*

A brief statement of the enactment relating to the legal status of the Aqueduct Bridge will be found in my report dated May 25, 1881 (House x. Doc. 156, Forty-seventh Congress, first session), in the remarks upon e fourth proviso of the act of March 17 of the same year.

That part of the legislative history of the Aqueduct Bridge which egins with the authority of the present lessees dates from the act of e general assembly of the State of Virginia passed on the 16th day f May, 1866. By this act, for the annual rent of $1,000, Henry H. Wells, Philip Quigley, and William W. Dungan became the lessees for e period of ninety-nine years. Under their authority and at their xpense the bridge was completed March 19, 1868, and was declared a legal structure by act of Congress approved July 27, 1868. (See Statutes at Large, vol. 15, page 231.) This act consists of a preamble and seven sections, which are substantially as follows:

The preamble states that, by act of Congress of May 26, 1830, the Alexandria Canal Company was incorporated, and authorized to construct, operate, and maintain a canal from Georgetown, in the District of Columbia, to Alexandria, in the State of Virginia, with an aqueduct across the Potomac River at Georgetown; and, further, that, by an act of the General Assembly of the State of Virginia (February 16, 1866), the Board of Public Works was authorized to unite with the corporate authorities of the city of Alexandria in making disposition of the Alexandria Canal; and by joint vote of the Board of Public Works and by the vote of a majority of the stockholders of the said canal company the president and directors of the said canal company were empowered and directed to lease the said canal for the period of ninety-nine years; and that, on the 16th day of May, 1866, the said president and directors did grant, lease, and convey the said canal, its aqueduct, locks, banks, lands, gates, and property of all description to Henry H. Wells, Philip Quigley, and William W. Dungan.

Section 1 declares the aqueduct to be a legal structure.

Section 2 authorizes and empowers the lessees to maintain and operate said aqueduct, and also to erect, build, operate, and maintain upon and over the stone piers upon which the aqueduct now rests a bridge for the passage of persons, animals, and vehicles.

Section 3 empowers the lessees to lay out and operate a raili said bridge.

SEC. 4. *And be it further enacted*, That as soon as the Chief Engineer (shall certify to the Secretary of War that the said bridge is so far compl ready, fit, and convenient for the passage of persons, animals, and vehic lessees, and their legal representatives may demand, have, and receive, the following tolls, to wit: For any foot passenger crossing on said brid for any horse, mule, or jack, any ox, or other horned cattle, 5 cents; for drawn by one animal, 15 cents; drawn by two animals, 25 cents; drawn mals, 35 cents, but no extra charge shall be made for the driver of such any hog, sheep, or other live creature, 1 cent; which certificate shall be p three weeks in two daily papers in the city of Washington at the expense pany: *Provided, however*, That it shall be lawful for said lessees to commut to persons requiring yearly passes. * * * *Provided, however*, That sa open and free for the passage of troops and munitions of war by the U without charge or compensation or any kind.

SEC. 5. *And be it further enacted*, That in case the bridge shall not be full within five years from the passage of this act, then this act shall be null

Section 6 prohibits the lessees from granting exclusive pri rights to any corporation.

SEC. 7. *And be it further enacted*, That the right is hereby reserved to (amend, alter, or repeal this act.

Approved July 27, 1868.

As before stated, the bridge was completed March 19, 1868; tificate required by section 4 of the above act was issued Ja 1869, in a letter by General A. A. Humphreys, Chief of Engin dressed to the Hon. J. M. Schofield, major-general and Secretary By this certificate the bridge was declared "ready, fit, and co for the passage of persons, animals, and vehicles," and the less authorized "to demand, have, and receive, in advance," the specified in section 4 above quoted.

GENERAL DESCRIPTION OF THE BRIDGE AS COMPLETED MA 1868.

The piers of the aqueduct, constructed to carry the Chesape Ohio Canal across the Potomac River, were built under the (of Capt. William Turnbull, Corps of Topographical Engineers, composed of heavy blocks of gneiss, quarried about one mile b Little Falls Bridge, on the Potomac; each pier has an ice-br cut granite, quarried in Sandy Bay, Massachusetts. Between t ments are eight piers, about 110 feet between the faces at the to third pier (two in all) is 16 feet wide at top; the remaining s are 7 feet wide. The top of each pier is about 30 feet above (high-water mark. According to the first design the superstruc to be of stone arches, but, for reasons of economy, a trough of l wood was substituted, of the pattern designed by Colonel Lon Topographical Engineers.

The aqueduct was used by the Government during the war, tl being drawn from the trough, and a roadway laid upon the flo bridge becoming much decayed, its place was supplied by the who built the present structure, which is a Howe truss, stren by arch-ribs.

The trough of the aqueduct and the tow-path rest on the low(and a highway bridge and foot-path rest on the upper chord.

Upon each of the narrow piers the arch-ribs of one span abut the arch-ribs of the next span, a wrought-iron plate being inse tween them; over the abutment piers the arch-ribs abut again cks of Georgia pine. At the north end three Howe trusses span the nal and connect the roadway of the bridge with one of the streets of rgetown (Bridge street); at the south end a trestle bridge connects e roadway with the Virginia shore.

REPORT OF AN EXAMINATION CONCLUDED MARCH 16, 1886.

In making the examination a hatchet was used to sound the timber, d a pick and augur were employed to penetrate all such places as exited signs of decay. The condition of the parts will now be given the same order as that adopted in the report of April 14, 1884.

For convenience of description I have divided the bridge into three eral parts, beginning at the north-end: First, the Georgetown apach; second, the aqueduct proper; and, third, the Virginia approach.

GEORGETOWN APPROACH.

This approach consists of three parts, viz:

	Feet.	In.
(1) An abutment and two stringers, 5 inches by 12 inches, with cross-planking from M or Bridge street to truss over canal	25	0
) Three trusses spanning the Chesapeake and Ohio Canal	107	9
) A series of trestles extending to the aqueduct proper, and supporting the roadway	173	0
Total	305	9

Its condition will now be given:

(1) The abutment is in fair condition.

(2) The trusses are strong and in good condition, but the floor beams, by 12 inches in cross-section, resting on the lower chords, and suprting the carriage-ways and foot-paths, are in very bad condition.

The defective floor-beams are given below in order, beginning from e Georgetown end:

FLOOR-BEAMS OF EAST ROADWAY.

No. 3. rotten 6 inches in depth at end.
No. 4. rotten 3 inches in depth at end.
No. 5, rotten 4 inches in depth at end.
No. 6, rotten 5 inches in depth at end.
No. 7. rotten 6 inches in depth at end.
No. 8. rotten entirely through at end.
No. 9, rotten 6 inches in depth at end.
No. 10. rotten 6 inches in depth at end.
No. 11. rotten 4½ inches in depth at end.
No. 12. rotten 4 inches in depth at end.
No. 13. rotten entirely through at end.
No. 15. rotten entirely through at end.
No. 17. rotten entirely through at end.
No. 19, rotten entirely through at end.
No. 21, rotten 6½ inches in depth at end.
No. 22, rotten half cross-section at end.
No. 23, rotten 4 inches in depth at end.
No. 24. rotten 4 inches in depth at end.
No 25. rotten entirely through at end.
No. 26. rotten two-thirds cross-section at end.
No. 27, rotten 5½ inches in depth at end.
No. 28, rotten entirely through at end.
No. 29. rotten 4 inches in depth at end.
No. 30. rotten 6 inches in depth at end.
One inner brace at Georgetown end of truss rotten 3 inches in depth.

FLOOR-BEAMS OF WEST ROADWAY.

No. 2, rotten entirely through at end.
No. 3, rotten 10 inches in depth at end.
No. 5, rotten 6 inches in depth at end.
No. 6, rotten 6¼ inches in depth at end.
No. 8, rotten 2 inches in depth at end.
No. 9, rotten 8 inches in depth at end.
No. 11, rotten 2 inches in depth at end.
No. 14, rotten 4 inches in depth at end.
No. 17, rotten 5¼ inches in depth at end.
No. 20, rotten 3¼ inches in depth at end.
No. 21, rotten 10 inches in depth at end.
No. 23, rotten 1 inch in depth at end.
No. 27, rotten 10 inches in depth at end.
No. 29, rotten 3¾ inches in depth at end.
No. 30, rotten 5 inches in depth at end.
No. 33, rotten 4 inches in depth at end.

(3) The trestles are in good condition, but require slight rep

AQUEDUCT PROPER.

The elevation and plan in the drawing (A) present a view west looking down stream.

Reference is made by figures to panel points; the even numl to the lower chord; the odd numbers refer to the top chord.

This division contains the roadway and aqueduct beneath it, span is constructed of wood, of the pattern known as the Ho It is composed of two trusses, an up-stream truss and a dow truss. Each truss is between two arch-ribs, making four ar each span. Each arch-rib is composed of four pieces, excep stream rib, which has five pieces.

There are nine spans. The average length of each chord is 11 the total length between extreme angle blocks is 1,064 feet.

The following statement includes the counter-braces, which w ted in the report of 1884. The dangerous effect of the moving l these braces is neutralized when the bridge carries its load All timbers were examined which exhibited to the ear, when t sounded, or to the eye some indication of deterioration. Many timbers may have escaped examination.

The condition of the various parts as ascertained by the exa is as follows:

FIRST SPAN.

Down-stream truss and arch.

At 2, end of first and third pieces of inner and third piece of outer arch

At 2, 4, and 6, fourth piece of arch-rib rotten.

At 4, angle-block broken.

At 6, outer brace rotten 2 inches in depth; counter worthless, old, and c end.

At 12, counter loose.

At 13, first, second, and third pieces of arch-rib rotten 3 inches in der block crushed.

At 14, third piece of cord rotten.

At 17, fourth piece of inner arch-rib rotten 5 inches in depth; angle-bloc

At 18, carriage-beam rotten.

From 18 to 20, fourth piece of inner and outer arch-ribs badly rotten.

Up-stream truss and arch.

At 2, first, second, and third pieces of arch-rib rotten; three posts rotte

At 4, carriage-beam weather-cracked and rotten; fourth piece of arch-ri

From 5 to 11, first and second pieces of chord rotten 2 and 3 inches in depth.
At 6, first and second pieces of chord slightly rotten.
From 6 to 8, first piece of arch-rib rotten.
At 8, 10, and 12, carriage-beams rotten, split, or defective.
At 10, counter too short; does not reach angle-block.
At 12, counter lacks 6 feet of reaching chord.
At 13, fourth piece of chord rotten 3 inches in depth.
At 14, all pieces of chord slightly rotten.
At 15 and 17, angle-blocks broken.
At 20, second piece of arch-rib crushed; fourth piece rotten.

SECOND SPAN.

Down-stream truss and arch.

From 3 to 5, third piece of arch-rib rotten.
At 4, carriage-beam split and rotten; angle-block broken.
From 4 to 6, first, second, and third pieces of arch-rib rotten and shaky.
At 5, fourth piece of arch-rib rotten.
At 7, second and third pieces of arch-rib rotten 4 inches in depth.
From 7 to 9, fourth piece of arch-rib rotten.
At 8, counter worthless; old timber.
At 10, counter rotten.
From 10 to 12, second and third pieces of chord rotten.
At 11, fourth piece of chord rotten; both counters rotten.
At 12, suspension block crushed.
From 13 to 19, fourth piece of arch-rib rotten and shaky.
At 14, second and fifth pieces of chord rotten; timber and counter defective.
At 15 and 18, angle-blocks broken.
At 16, first piece of outer arch-rib crushed; second and third pieces of chords rotten.
At 18, third piece of chord and third and fourth pieces of inner arch-rib rotten 2 inches in depth.

Up-stream truss and arch.

At 1, first piece of chord rotten half way through.
At 2, outer post rotten; side of arch-rib rotten.
From 2 to 4, top piece of arch-rib rotten 3 inches in depth; old and split.
At 3, second piece of chord rotten 4 inches in depth,
At 5, 6, 15, and 17, angle-blocks broken.
At 5, first piece of chord rotten 4 inches in depth.
From 7 to 11, second piece of chord rotten 3 inches in depth.
From 9 to 13, top piece of arch-rib cracked, rotten, and cut into.
At 10, outer brace rotten 3 inches in depth and weather-cracked; counter rotten at foot.
At 10, 12, and 18, carriage-beams old and rotten.
At 13, first and third pieces of chord rotten 3 and 4 inches in depth.
At 14, outer brace rotten 2 inches in depth.
At 15, top piece of arch-rib rotten 4 inches in depth.
At 16, outer brace half section rotten.
At 17, first piece of chord rotten 3 inches in depth.
At 18, angle-block crushed.

THIRD SPAN.

Down-stream truss and arch.

At 2, outer post rotten at foot.
From 2 to 8, first piece of chord old, rotten, and weather-cracked.
At 3, 4, 5, 6, and 7, angle-blocks broken.
From 7 to 11, top piece of arch-rib badly rotten and weather-cracked.
At 10, under side of chord crushed into and rotten.
At 12, third piece of chord rotten; chord somewhat crushed between angle-block and gib-plate.
At 13, inside of outer arch-rib rotten where braces cross.
From 13 to 15, first piece of chord weather-cracked and rotten.
At 15, outer brace old and rotten.
From 14 to 16, second piece of chord rotten.
At 16, counter broken.
At 20, top piece of inner arch-rib rotten.

Up-stream truss and arch.

From 2 to 4, first piece of arch-rib rotten; fifth piece rotten entirely thro

At 3, 5, 6, 7, 16, and 18, angle-blocks broken.

At 4, second piece of chord rotten 3 inches in depth.

At 6 and 18, carriage-beams rotten and weather-cracked.

At 7, second piece of chord rotten 4 inches in depth.

At 8, outer brace rotten 5½ inches in depth.

At 9, first piece of chord rotten 6 inches in depth.

From 9 to 11, first and third pieces of chord rotten 3 inches in depth.

From 9 to 13, top piece of arch-rib rotten entirely through.

At 12, both counters very poor; cracked and sections small.

From 13 to 15, first and third pieces of chord rotten from 3 to 4 inches in d

At 15, top piece of outer arch-rib rotten 5 inches in depth.

At 18, third piece of chord rotten 2 inches in depth; inner brace rotten 4 depth.

At 20, first piece of chord rotten 3 inches in depth; three braces rotten 3 i depth; inner post rotten 6 inches in depth.

FOURTH SPAN.

Down-stream truss and arch.

At 1, both posts shaky.

At 2, timber skew-back crushed; third piece of arch-rib rotten.

At 3, 5, 7, 10, 12, and 15, angle-blocks broken; at 10, badly crushed.

At 4, inner side of arch-rib rotten; carriage-beam weather-cracked, and timber of both braces old, weather-cracked, and defective.

At 5, fourth piece of chord shaky.

At 6, third and fourth pieces of chord rotten.

From 7 to 15, top piece of arch-rib old, weather-cracked, and rotten.

At 18, under side of carriage-beam rotten and crushed.

Up-stream truss and arch.

At 2, fifth piece of outer arch-rib and whole of inner arch-rib rotten; abo section of inner brace rotten; inner post partly rotten.

From 2 to 4, second piece of chord rotten 6 inches in depth; fourth piece h tion rotten.

At 5, top piece of arch-rib rotten 5 inches in depth.

At 6, chord lacks 4 inches of cross-section.

At 7, 8, and 14, angle-blocks broken.

At 8, second piece of chord rotten 6 inches in depth; third piece of chord r inches in depth.

From 9 to 11, first and third pieces of chord rotten 2 and 3 inches in depth.

From 9 to 13, top piece of outer arch-rib very defective.

At 10, counter 4 feet short of reaching chord.

At 10 and 14, carriage-beams rotten and weather-cracked.

At 12, third piece of chord rotten 5 inches in depth; fourth piece rotten 3 in depth.

From 13 to 15, top pieces of outer and inner arch-ribs rotten and cracked.

At 14, outer brace rotten entirely through.

At 16, both braces rotten 5 inches in depth.

From 18 to 20, fourth piece of chord and inner post rotten; fourth piece o arch-rib rotten half-way through.

At 20, in outer arch-rib at end, first piece rotten half-way through; seco third pieces wholly rotten; fourth piece four-fifths of section rotten; fift slightly rotten.

FIFTH SPAN.

Down-stream truss and arch.

At 3, 4, 5, 7, 13, and 15, angle-blocks broken.

At 6, outside brace slightly rotten; counter lacking.

From 6 to 10, fourth piece of chord rotten.

From 7 to 15, top piece of arch-rib old and rotten.

At 8, outer brace rotten 3½ inches in depth.

At 10, blocking on carriage-beam rotten.

At 11, second piece of chord rotten 5½ inches in depth; inner brace shaky a ten.

At 12, second and fourth pieces of chord rotten 3½ inches in depth.
From 13 to 15, top piece of inner arch-rib rotten and shaky.
At 14, carriage-beam rotten; second and third pieces of chord rotten 2½ inches in depth.

Up-stream truss and arch.

At 2, outer post out of place; second, third, and fourth pieces of arch-rib rotten 4 to 6 inches in depth.
From 2 to 4, first and second pieces of chord rotten 3 to 3½ inches in depth.
At 3, 4, 5, 6, 15, and 18, angle-blocks broken.
At 6, 8, 10, and 18, carriage-beams old, weather-cracked, and rotten.
At 8, counter rotten at foot.
At 10, gib-plate crushed into chord.
At 12, one counter 5 feet short; other counter old and rotten at foot.
At 12 to 14, second piece of chord rotten 2 inches in depth.
At 13, second piece of chord rotten 3½ inches in depth.
At 14, third, fourth, and fifth pieces of chord rotten 2 to 4 inches in depth, and weather-cracked.

SIXTH SPAN.

Down-stream truss and arch.

At 1, third piece of arch-rib old and rotten.
At 3, 5, 7, 13, 15, 17, and 18, angle-blocks broken.
At 4, outer brace rotten 2 inches in depth.
From 6 to 8, second, third, and fourth pieces of chord rotten 2 to 3½ inches in depth.
From 7 to 15, top piece of arch-rib old and rotten.
At 12, second piece of chord rotten 2 inches in depth; counter worthless, rotten at end, section small.
At 13, outer brace crushed and split at upper end.
From 14 to 16, second and third pieces of chord rotten 2 to 2½ inches in depth.
At 16, gib-plate crushed into chord.
At 20, inner post rotten.

Up-stream truss and arch.

At 2, third and fourth pieces of arch-rib rotten 3 inches in depth.
At 4, 6, 15, and 16, angle-blocks broken.
At 4, 8, 12, 14, and 16, carriage-beams old, weather-split, and rotten.
From 5 to 9, top piece of outer arch-rib rotten.
At 6, defective blocking at carriage-beam.
At 8, counter 5 feet short of reaching chord.
From 9 to 11, second and third pieces of chord rotten 3 inches in depth.
At 10, one-third section of outer brace rotten.
At 12, timber of both counters poor and old.
At 15, third piece of chord rotten 3 inches in depth.
At 17, top piece of arch-rib rotten and weather-cracked.
At 18, first piece of inner arch-rib crushed and worthless.
At 20, top piece of outer arch-rib cracked; timber skew-back slightly crushed.

SEVENTH SPAN.

Down-stream truss and arch.

At 2, half section of inner post rotten; second and third pieces of outer arch-rib rotten 1½ to 3 inches in depth.
At 3, angle-block broken in two places, and crushed into chord.
At 4, 5, 15, 17, and 18, angle-blocks broken.
At 4, end of inner brace crushed; second piece of chord rotten 6 inches in depth.
From 7 to 13, top piece of outer arch-rib old, rotten, and cut into.
At 8, timber of outer brace old, crushed at foot, and rotten.
At 10, 12, 14, and 18, timber of carriage-beams old, weather-cracked, or rotten.
At 10, both braces shaky, rotten, and crushed at foot; wooden blocking cracked; third piece of chord old and rotten.
At 12, third piece of chord rotten 2½ inches in depth; both counters, old timber and small section.
At 14, outer brace rotten 6 inches in depth; inner brace slightly rotten; counter loose.
At 15 top piece of inner arch-rib rotten 2 inches in depth.

Up-stream truss and arch.

From 1 to 3, first piece of chord rotten 3 inches in depth.

At 2, fourth piece of outer arch-rib rotten 4 inches in depth.

At 3, 5, 15, and 17, counters short; do not reach chord.

At 4, 5, 6, and 15, angle-blocks broken.

At 4, 6, 10, 12, and 14, carriage-beams old, weather-cracked, or rotten.

From 9 to 13, top piece of outer arch-rib rotten entirely through.

At 12, one counter 5 feet short; the other counter poor and of only half se

At 15, second and third pieces of chord rotten 1 to 3 inches in depth.

At 20, second, third, and fourth pieces of outer arch-rib rotten, nearly wo

EIGHTH SPAN.

Down-stream truss and arch.

At 2, end of third piece of inner arch-rib rotten.

At 3, 4, 5, and 6, angle-blocks broken.

At 6 and 18, carriage-beams crushed and shaky.

At 6, two pieces of chord rotten 4 inches in depth.

From 7 to 11, top piece of arch-rib old, weather-cracked, and cut into.

At 8, first, second, and third pieces of chord rotten from 1 to 6 inches in de

From 9 to 12, inner brace rotten at ends.

At 12, one counter 4 feet short, the other very poor.

From 12 to 14, first and third pieces of chord rotten 3 and 4 inches in depth

At 14, third and fourth pieces of chord rotten 2 and 6 inches in depth; fif poor.

At 15 and 17, counters too short; do not reach chord.

At 20, half section of both posts rotten.

Up-stream truss and arch.

At 2, first piece of outer arch-rib worthless at end; second poor; third and rotten 5 inches in depth; fifth slightly rotten.

At 3, 7, 13, 15, and 17, counters too short; do not reach chord.

At 4, angle-block broken in two places.

At 4 and 12, carriage-beams old and weather-split or rotten.

From 7 to 9, lateral brace rotten.

At 9, first piece of chord rotten 2 inches in depth.

From 9 to 15, top piece of outer arch-rib weather-cracked and rotten.

At 10, third piece of chord rotten 5 inches in depth.

From 11 to 13, intersection of lateral braces rotten.

From 12 to 16, top piece of outer arch-rib cracked at end.

At 14, third and fourth pieces of chord rotten 4 to 6 inches in depth.

At 14 and 18, angle-blocks broken.

From 17 to 19, third piece of chord rotten 3 inches in depth.

At 18, top piece of outer arch-rib old and rotten.

At 20, second piece of outer arch-rib at end rotten 4 inches in depth; t fourth rotten 2 inches in depth; fifth worthless.

NINTH SPAN.

Down-stream truss and arch.

At 2, first piece of outer arch-rib at end rotten about half section; secon slightly rotten.

From 2 to 4, first piece of chord rotten 5 inches in depth.

At 4, 6, 13, and 18, angle-blocks broken.

From 5 to 9, fourth piece of chord old and rotten.

At 6, inner brace old, rotten, and crushed.

At 7, block of suspension-rod rotten; counter too short.

From 7 to 19, top piece of outer arch-rib weather-cracked and rotten.

At 8, quarter section of inner brace rotten.

At 8 and 16, carriage-beams old and shaky.

From 8 to 9, inner brace old and weather-cracked.

At 10, angle-block crushed.

At 12, counter-brace lacking.

At 18, second, third, and fourth pieces of inner arch-rib rotten at side 2 inches in depth.

At 20, second piece of arch-rib rotten entirely through; third piece slightly rotten.

Up-stream truss and arch.

At 2, first piece of outer arch-rib rotten half section; second piece one-third section; third piece slightly rotten; fifth piece rotten entirely through.
At 4 and 18, angle-blocks broken.
From 5 to 7, first piece of chord rotten 2 inches in depth.
At 6, counter old and too short.
At 8, carriage-beam old and rotten.
At 10, one counter 4 feet short; the other counter 5 feet short.
At 11, first piece of chord rotten 4 inches in depth.
From 11 to 15, second piece of chord rotten 6 inches in depth.
From 10 to 12, third piece of chord rotten 3 to 4½ inches in depth.
From 12 to 18, top piece of inner arch-rib old and split.
At 14 and 16, counters 4 and 5 feet short.
From 18 to 20, second piece of inner arch-rib rotten entirely through.
At 20, second piece of arch-rib at end rotten 4 inches in depth; third and fourth pieces rotten entirely through; inner post weather-cracked.

The following further remarks are made in continuation of the examination of the aqueduct proper:

Counter-braces.—The counter-braces in many panels are lacking, and in others defective. Their use is mainly to resist moving loads, and any defect in them does not render the bridge unsafe when the aqueduct contains water.

Floor-beams of the aqueduct.—The plan calls for forty-five floor-beams beneath the trough. New beams have been placed beneath the floor; but in many of the spans old and decayed beams still remain. The number of good beams varies from thirty-five in the second span to fifty-five in the fourth and seventh spans.

Floor-beams of the deck or roadway.—The deck-beams and the stringers which rest on them require a general overhauling. Many of them are decayed. It was difficult to reach these beams, but from observations from below I should recommend the removal of the following, viz: Nine in the first span, eleven in the second, thirteen in the third, eight in the fourth, six in the fifth, eight in the sixth, nine in the seventh, thirteen in the eighth, and nine in the ninth; a total of eighty-six.

Hand-railing.—The hand-railing on both sides of the bridge is defective, and should be replaced.

Lateral braces to resist wind-strain.—Since the examination of 1884, the braces which were wanting in the upper chord have been replaced; but the braces of the lower chord remain in the same condition as when last examined, and cannot be replaced without removing the substruts beneath the bridge. The lateral braces which have been removed are shown by dotted lines. Their places are now supplied by the timbers A, B, and C. The straining-beam B is placed on the inside of the down-stream chord, which is the concave side; it extends for the distance of five central panels, and transfers the strains through the struts A and C to the foot of the first and last panels on the opposite or up-stream side of each span. This change was made necessary by the introduction of substruts and straining beams beneath the floor of the aqueduct, which has been employed to convey the pressure of the water to the piers. Each truss has also been connected with the piers by substruts.

Notwithstanding the support of the substruts, the bridge exhibits a tendency to turn about its horizontal axis, which tendency, first noted in 1876, was examined in 1884 and now again in March, 1886.

The following tables show the measurements of the overha the chord and arch of each span which were made in the ye and 1886:

Horizontal distance that the top chord overhangs the lower chord at the several inclination being up-stream.

Place.	Examination of 1884.	Examination of 1886.	Place.	Examination of 1884.
	Inches.	*Inches.*		*Inches.*
Georgetown abutment	4½	0	Fifth pier	—3½
First pier	8½	4½	Sixth pier	12
Second pier	10½	7	Seventh pier	9½
Third pier	16	5⅜	Eighth pier	11
Fourth pier	3¾	2⅝	Virginia abutment	7

Horizontal distance that the top of the arch overhangs a verticle plane through th the arch, the inclination being up-stream.

Place.	Examination of 1884.	Examination of 1886.	Place.	Examination of 1884.
	Inches.	*Inches.*		*Inches.*
Center of first span	5½	1⅜	Center of sixth span	6
Center of second plan	9½	4¼	Center of seventh span	13
Center of third span	14	6⅞	Center of eighth span	11
Center of fourth span	6½	2⅞	Center of ninth span	8⅜
Center of fifth span	—3	—2⅞		

This twisting or overhanging is due to the fact that the ce gravity of the bridge, when loaded with water, is 1.3 feet to the w the center of gravity of the bridge without the aqueduct and wat The removal of the lateral braces may in some measure encourag tendency, which is the probable cause of the deviation of the chord from a straight line. The convex side is up-stream. The a of deviation is shown in the following table:

Ver. sin. of chord.

Number of span.	Examination of 1884.	Examination of 1886.	Number of span.	Examination of 1884.
	Inches.	*Inches.*		*Inches.*
First	5	1¼	Sixth	7
Second	6	3	Seventh	10
Third	11	5⅛	Eighth	8½
Fourth	3¾	1	Ninth	7
Fifth	—3½	—3⅛		

These three tables show that the dangerous defect noted in and first measured in 1884, is much reduced at the present date (1886). This improvement has been made by the superintendent pairs. To counteract this tendency to twist or revolve a fram was recommended in the report of 1884 (see drawing B), which be erected after the trunk was restored to its vertical position. mits the passage of canal-boats over the aqueduct. Two have erected, one on pier 3, the other on pier 6. One should be pla the center of each span, if the bridge is to be permanently maint

Settlement of the arch-ribs.—The superintendent states that the top of the arch-ribs was about 3 inches below the top of the chord when first completed. No measurements, however, were kept.

The following observations are interesting as data for further comparison.

The table shows the number of inches that the top of the arch is vertically below the top of the chord, and also the difference between the observations of 1884 and 1886:

Number of arch.	Down-stream outside arch-rib.				Up-stream outside arch-rib.			
	Top of arch below top of chord.		Settlement.		Top of arch below top of chord.		Settlement.	
	1884.	1886.	1884.	1886.	1884.	1886.	1884.	1886.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
First	6	6½	3	3½	8	8½	5	5½
Second	7	8½	4	5½	3	3	0	0
Third	6	6	3	3	5	6½	2	3½
Fourth	2	3½	−1	½	6	7½	3	4½
Fifth	6	6	3	3	7	7	4	4
Sixth	4½	5⅝	1½	2⅝	8	8	5	5
Seventh	4	6⅞	1	3⅞	7	8	4	5
Eighth	6	9½	3	6½	4	5⅞	1	2⅞
Ninth	11½	16	8½	13	13	14½	10	11½

It would not be safe to predicate any statement upon the above table, since the reference plane of the arches is not known with certainty. The settlement of all the arches appears to average about 4 inches, and the arch of the ninth span seems to have settled the most. Since 1884 the actual settlement has been 1½ inches in the up-stream arch and 4½ inches in the down-stream arch. The effect of this difference in the altitude of the arches must be to engender unequal strains, which, however, do not appear to be of sufficient value to endanger their stability.

Remarks on the arches.—It was originally intended that the arches should convey the strains directly to the piers; as constructed, however, each arch abuts against the arch of the next span, and any derangement in one or inequality in the force is conveyed through the series. The effect of unequal forces is apparent upon the heel-plates between two successive arches. In cases where the decayed rib-pieces have given way the plate is much bent by the abutting end of the opposite and undecayed arch.

Addition of arch-ribs.—It is said that the truss was originally designed to sustain the entire load, and that the arch was afterwards added under the following conditions:

When the water was first let into the trough the angle-blocks gave way; new angle-blocks were substituted, and arch-ribs were then added. If this statement is correct, the arch-ribs must have been added before the inspection made by Major Michler, for this officer mentioned them in 1869. The arch-ribs and truss are now necessary to support the entire weight of the aqueduct and moving load. The actual assistance rendered by the arch-ribs and the trusses depends on the relative degree to which the vertical rods pertaining to each are screwed up. The entire load may be divided between the truss and the arch, or may be thrown upon either; but it would not be safe, at the present time, to trust the load to the support of the truss alone or of the arch alone when the water is in the aqueduct.

Defect of arch-ribs.—When constructed it was found nec the upper part of the ribs to admit the washers, nuts, and cross rods connecting the upper chords at the middle of The upper pieces of the outer ribs were also cut into to pr zontal seat for the blocks upon which the washers of the rods rest, thus reducing the effective cross-section of the s

Masonry of piers.—The piers, completed about the yeai good condition. A certain amount of deterioration was c noted, but it was not measured. It consists in the remo ment from between the joints of the ice-breakers, and a joints on each side of the piers. This defect is progressive, it may be some years before danger can be apprehended fro the repairs should be thoroughly made and at an early dat

VIRGINIA APPROACH.

This approach is composed of bents, or trestles, extend abutment; each bent is formed of a ground-sill, three post supporting a roadway. The distance from the end of the the abutment on the road is 447 feet. These trestles h paired since the examination made in 1884, and may be c be in a fair condition. Some few rotten timbers, posts, and should be replaced.

It is evident from the above examination that the two ap be easily repaired, and that the division which should be c sidered is the aqueduct proper.

Before the Senate inquiry can be answered the ability of the bridge to resist the strain to which it is subject should determined by calculation.

CALCULATION OF STRESSES ON THE TRUSS AND ARCH O BRIDGE.

The calculation of the strength will be made on three hy

First. That the truss sustains the permanent and movin

Second. That the arch sustains the permanent and movi

Third. A brief consideration of the part which arch a form in supporting the permanent and moving loads.

(1) THAT THE TRUSS SUSTAINS THE ENTIRE LOAD, PER MOVING.

Since January 9, 1869, the date of the certificate of the gineers, the bridge has been in continuous use. During th repairs the water is drawn from the aqueduct; the uppe used for ordinary travel. Five years after its completio pairs are said to have been made; since this time the w annually repeated. It is therefore proper to recalculate which the bridge was designed to resist and those to wh subject, in order to ascertain its present strength.

From the examination just made it is evident that the r have been made annually for the past ten or twelve ye been co-extensive with the decay, and that a progressive is noticeable throughout the structure. The new pieces which have been substituted for the old differ not only i but often in the kind of timber employed.

f timber.—The kind of timber used cannot be ascertained with i. At the present time the different kinds are distributed nearly rs: The chords contain about equal quantities of Georgia and arolina pine; the main braces are composed of four-tenths of and the remaining six-tenths are divided between North Carowhite pine; the lateral and counter braces are wholly of white e floor beams of the aqueduct are of Georgia pine, and the floor-Virginia pine; the floor of the highway bridge is also of Virie. The arches are of white pine, and the skew-backs on each r are of Georgia pine. The weight of the different kinds of sed in the bridge, distributed as above, has been carefully del.

t of structure per panel.—The weights per square foot are as fol-

Kind of material.	Weight per cubic foot.	Kind of material.	Weight per cubic foot.
	Pounds.		*Pounds.*
mber	44.6	North Carolina pine	34.3
e	38.5	Virginia pine	34.3
	25.0	Water-soaked pine	45.0

eight of the structure per panel, based on the above weights,) pounds.

t of water per panel.—The dimensions of the aqueduct, taken e original drawing and used in the calculations made in 1884, than those determined by measurement. This has been caused ressure of the water, which has increased the width and depth queduct, and has caused it to sag in the middle of each span. ght of the water varies on different days, being greatest on Sun-l its weight varies with the amount of sedimentary matter held on. Taking the dimensions found by measurement, and 62½ as the weight per cubic foot, the weight of water per panel is 3,000 pounds. By employing this weight the factor of safety reduced.

t of moving load per panel.—About this weight engineers, theond practical, differ in opinion; a difference due to the estimahe weight which the bridge may be called on to support.

oadway of the Aqueduct bridge is often crowded with spectators e collected to view a boat race. It would not therefore be safe ne a load less than 90 pounds per square foot, or nearly 1 ton ning foot. This is substantially the same weight as that recled by a committee of the American Society of Civil Engineers. . 4 Transactions, page 124.) With this weight the load of each ill be 27,000 pounds. It is safe to assume that the timber of s and arch has an ultimate compressive strength of 3,333 pounds are inch and an ultimate tensile strength of 7,500 pounds per nch.

UP-STREAM TRUSS.

lowing dimensions have been taken:

f truss	feet	111.33
f panel	do	12.37
etween center of upper and lower chords	do	21.92
tween center of chords	do	25.50
roadway	do	24.30
f panels in span		

The following weights have been taken:

Weight of water per panel .... pounds
Weight of structure per panel .... do..
Weight of living or moving load per panel .... do..

Total weight of structure, permanent and moving loads .... do...
Tangent, .564; secant, 1.148.

The total is greater than that assumed in 1884, the excess b to the larger amount of water in the aqueduct, which will have t of slightly reducing the factors of safety. The center of gravit Aqueduct Bridge, on account of the position of the trough, acts u up-stream side with a leverage of 1.3 feet; and the top and chord of each panel on this side will be called on to support 83,420 The load on each panel of this truss will, therefore, exceed the the down-stream side by 15,440 pounds.

The weight of 83,420 pounds must be unequally divided betw top and bottom chord, the top chord supporting 22,020 pounds equal to the moving load), and the bottom chord supporting pounds (not quite three-fourths of the weight of water).

The total load, moving and permanent (151,400 pounds), is between the upper and lower chord of each panel as follows:

Weight per panel divided between chords and trusses.

Member.	Up-stream truss.	Down-stream truss.	T cho an stre
	Pounds.	*Pounds.*	*P*
Upper chord	22,020	17,944	
Lower chord	61,400	50,036	
Totals	83,420	67,980	

In this truss the compression of the top chord and the tension bottom chord are greatest at the central panel, and the greatest on the braces is found next to the abutments.

These parts will now be considered, and as the strength of the t depends on its weakest member, the strain which such member will be given.

The permanent and moving loads will first be considered as a p nent load only, of 151,400 pounds.

The timber being *assumed* as sound, the stresses on the chord braces will be as follows (Shreve and Humber):

Chords of up-stream truss.—The greatest stress in either chord is in the middle of the panel, and is made up of the transverse str the moment of rupture of the beam added to the compression in t chord, and to the tensile stress in the bottom chord, in order to mine the entire stress in either of these chords.

This rule, recommended by Trautwine (ed. 1885, p. 498) and bas the experiments of Hodgkinson, depends on the fact that in the truss the load is equally distributed along the chord, and is not, iron bridges, concentrated at the panel points.

In the top chord the central panel will be subject to a compr stress of 470,487 pounds, which, added to the transverse stress moment of rupture, 34,048 pounds, will give, after deducting for defects in the timber, and in seasoning, a factor of safety of 1.46.

e bottom chord the central panel will be subject to the tension 87 pounds, which, added to the transverse stress of the moment ıre, 94,940 pounds, will, after the reduction of the constant for easoning, kind of timber, &c. (Trautwine, ed. 1885, pp. 463 and 'e a factor of safety of 2.28.

ı *of up-stream truss.*—The formula used at the present time to ıe the strength of braces is that of Gordon, or of Shaler Smith, ased on the experiments of Hodgkinson, reported between 1840 ' (Trautwine, ed. 1885, p. 458). By these writers the brace is ıs a pillar subject to flexure under pressure.

ro braces at 2–3 or at 17–18 are subject to a compression of ›ounds on an area of 288 square inches; treated as a pillar, ac- :o the formula of Shaler Smith, the two weakest braces com- 're a factor of safety of 1.06.

ls of the up-stream truss.—The three tie-rods at 3–4 or at 17– ubject to a tension of 26,128 pounds per square inch, which [illegible] pounds—a factor of safety of 1.54 (Trautwine, ed. 1885, p. ıe three tie-rods at 5–6 or at 15–16 have a factor of safety of ıese rods are still sound and have outlived the wooden parts idge, which have been repaired annually for ten or twelve years.

DOWN-STREAM TRUSS.

:uss will be called on to bear a load, permanent and moving, 151,400—83,420 = 67,980 pounds, which will be divided between ınd bottom chords; the top chord supporting 17,944 pounds, oottom chord supporting 50,036 pounds.

ctors of safety of this truss, computed by the same formula, are an the factors of the up-stream truss, and need not be further ed.

me remark applies to the factors of safety of the tie-rods.

MOVING LOAD.

hen the aqueduct contains water.—The effect of the passage of ats cannot be easily determined. The water will be displaced ›at enters and the wave which follows will increase the load on ge in a small degree.

fect of the moving load of 27,000 pounds upon the deck is more etermined, but its effect is neutralized by the inertia of the

hen the water is withdrawn.—In this case the factor of safety in :hord is 3.10, but in the lower chord the stress becomes tensile, :s a factor of safety of 8.2.

ounter-braces have sufficient strength except in the central ›ut are inefficient or lacking in the first, fourth, fifth, seventh, :h spans, and are defective in all the other spans.

ıain braces next to the abutment will sustain a stress of 145,566 which gives a factor of safety of 2.8. The factor of safety of e tie-rods at one point, either 3–4 or 17–18, is 4.5.

ıain braces are the weakest parts, yet when the timber *was in ndition* they supported the load without danger, although the ' safety is unusually small.

ʗ THE ARCH SUSTAINS THE PERMANENT AND MOVING LOADS.

pace between two piers may be generally described as being by a Howe truss and an arch. To speak accurately, however, the space between two piers is spanned by two trusses and ribs, one arch-rib on each side of each truss. Each arch-ri posed of four pieces, hewed to the curve, except the up-stream which has five pieces. (See drawing A.)

The arch-ribs are independent of the trusses, that is, no con made between them by bolts, ties, or struts. The truss sup roadway upon its upper chords, and the aqueduct upon its lowe the arch lends its aid to support the truss with its entire load of carriage-blocks, which are suspended beneath the lower c rods. (See drawing A.) The arch is therefore auxiliary to These carriage-blocks were originally beams which extended the two lower chords of the truss, but were subsequently cut room for the introduction of the straining beams beneath the a

UP-STREAM ARCH.

The following data are employed:

Span of arch..feet.
Distance of center of gravity of half truss ....do..
Distance from center of pressure of skew-back to center of pressure o crown..feet..
Cross-section of arch in middle of span ....square inches..
Cross-section of arch at skew-back ....do....
Load on span ....pounds..
Pressure at crown of arch ....do....
Pressure at skew-back ....do....
Factor of safety at crown, in arch as originally constructed ....
Factor of safety at skew-back, in arch as originally constructed ....

(Humber's Handy Book, page. 48.)
The suspension rods have a factor of safety of 2.45.

On account of decay 450 square inches should be deducted f sectional area of the two arch-ribs in the up-stream arch of th span, leaving an available cross-section of 360 square inches, wh have a factor of safety of 1.67. This arch is the weakest at the time in the bridge.

In four of the arch-ribs, viz, the first, seventh, eighth, and ni sectional area should be reduced on account of decay by deduct square inches, leaving an available sectional area of 540 square which will have a factor of safety of 2.51. These factors of the a based on an ultimate crushing strength of 3,333 pounds per squa

As the up-stream arch is called on to bear the greater weight it be the stronger of the two.

(3) CONSIDERATION OF THE PART WHICH ARCH AND TRUSS FORM IN SUPPORTING THE PERMANENT AND MOVING LOA

The two systems must now be considered as acting togeth jointly supporting the load which rests primarily upon the truss.

The resistance which each system can offer has been determi calculation, but it is not practicable to proportion the resistance each should actually offer to sustain a given load. The adjustn resistances between the two systems must be left to the judgment superintendent. He can determine which must be the greater, b not determine its value in pounds or in tons.

The combination of truss and arch as it exists in the Aqueduct was employed in wooden bridges designed as late as 1870. W affords certain facilities for making repairs it does not admit, i struction, of that economy of material which is desirable in b built of iron or steel.

The method employed to obtain the results given below will be in Haupt on Bridge Construction, page 189.

one-fourth, as recommended by the same author (edition 1885, 3).

races.—The area of the braces next to the abutment is 288 square Shaler Smith's formula is employed, and no deduction is made constants other than that included in the formula (Trautwine, 1885, page 458). The combined action of the truss and arch is ed according to Haupt (Bridge Construction, page 188).

rches.—The area of the two arch-ribs, after deducting the decay observed, is 360 square inches at the skew-back. The constant ression reduced one-third, according to Trautwine, will be 3,333 per square inch.

uspension and tie-rods.—The average breaking strength assumed recommended by Trautwine, which varies from 40,320 pounds are inch for rods 2¼ inches in diameter to 42,560 pounds per nch for rods 1¾ inches in diameter.

the above data the following factors of safety have been de- d:

op chord	2.35
ottom chord	2.47
races	2.82
rch at skew-back	4.91
nsion and tie rods	2.20

ie-rods exhibit no appearance of deterioration, although they en in use for seventeen years, during which time the wooden ave been renewed ten or twelve times.

ctor of safety of the arch at skew-back is double that of the sus- and tie-rods together. The excess may be designed to prevent nge in the form of the arch.

moderate yet sufficient strength when originally constructed, educt lacks cross-bracing necessary to give rigidity and to re- tendency to revolve on its horizontal axis. To prevent this y a system of cross-bracing was recommended in 1884, but was ied out. It is shown in drawing B, and is designed so as to leave structed way for the canal-boats. One of these frames should

Aqueduct proper.—The Aqueduct Bridge when the water is w can be made safe for the passage of persons, animals, and v the completion of the following repairs:

All decayed and defective timber should be replaced by sou of the proper dimensions. The floor, floor-beams, and much trunk can be removed.

The straining beams and substruts will not be needed and replaced by the lateral braces. The counter-braces now want central panels of each span should be supplied. The old struts against the sides of the aqueduct are in good condition, b be properly fitted into new floor-beams placed beneath the aq

The old flooring of the roadway should be replaced by a new

The trusses and the arches should be restored to their origi cal position, and should be maintained by diagonal ties. Brac added if necessary. (See drawing B.)

Many of the carriage-blocks in each span are defective or The efficiency of the arch depends on the condition of these bl forty-five have been counted which should be at once renewed.

The chords and parts most liable to decay should be kya covered with zinc.

After the completion of the repairs the bridge should be pro justed by screwing the nuts of the tie-rods, and unremitting a should be given to the maintenance of the proper adjustmen load upon the trusses and arches.

When the bridge is repaired further settlement of the arch ma vented by replacing the old timbers with new of exactly the mensions and by employing heart pine for the skew-back and of the arch adjacent thereto. Iron plates should be employe abutting ends of the arch-ribs.

Kyanized timber used by Captain Turnbull.—The duration of k timber is of sufficient importance to be placed upon record. ment of kyanized wood used by Captain Turnbull is in my pos It weighs 44.6 pounds per cubic foot, and is in perfect conditi age can be nearly determined. The last date in the journal wh kept during the construction of the piers is December 16, 18 suming that the wooden trough was completed three years la specimen in my office will be forty-six years old in December, 1

The distinguished engineer James B. Francis testifies to the value of the *Kyan* process.

ANSWER TO THE SENATE RESOLUTION.

The answer to the Senate resolution of February 25, 1886, will l in the foregoing report of examination, which gives the conditio Aqueduct Bridge on the 16th day of March, 1886.

Coefficients have been established by the authorities on brid ing which represent the proportion that the ultimate strengt terials bears to the strain which can safely be brought upo Humber, one of the approved authorities on the subject, for pe load upon wooden structures, gives a factor of safety ranging fro

The strength of a bridge is determined by its weakest pa factor of safety of the weakest part of the Aqueduct Bridge is f the top chord, in which the coefficient is 2.35 when the bridge is with water and with the moving load. It is therefore evident th thus loaded the bridge cannot be pronounced to be safe for a of 90 pounds per square foot, and that, for the security of ordinary l, thorough repairs and unceasing diligence will be necessary to nt accident.

n indebted to the courtesy of Mr. W. W. Dungan, representing the s, for the offer of every facility for making a thorough examination e bridge.

Very respectfully, your obedient servant,

S. T. Abert,
United States Agent.

g. Gen. John Newton,
Chief of Engineers, U. S. A.

APPENDIX K.

EMENT OF THE HARBOR AT NORFOLK, VIRGINIA; APPROACH TO LK HARBOR, VIRGINIA; CURRITUCK SOUND, COANJOK AND ON BAYS, AND NORTH RIVER BAR, NORTH CAROLINA—IMPROVE- OF CERTAIN RIVERS IN VIRGINIA AND NORTH CAROLINA.

OF CAPTAIN F. A. HINMAN, CORPS OF ENGINEERS, OFFICER IN E, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, WITH OTHER IENTS RELATING TO THE WORKS.

IMPROVEMENTS.

at Norfolk, Virginia.
ch to Norfolk Harbor and the ed States (Norfolk) Navy-Yard, een Lambert's Point and Fort lk, Virginia.
attox River, Virginia.
ay River, Virginia.
ater River, Virginia.
's Hope River, Virginia.
Landing River, Virginia and h Carolina.
8. Edenton Bay, North Carolina.
9. Currituck Sound, Coanjok Bay, and North River Bar, North Carolina.
10. Meherrin River, North Carolina.
11. Pamplico and Tar rivers, North Carolina.
12. Yadkin River, North Carolina.
13. Scuppernong River, North Carolina.
14. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., July 22, 1886.

RAL: I have the honor to transmit herewith my annual report e works of river and harbor improvement in my charge for the ar ending June 30, 1886.

ery respectfully, your obedient servant,

F. A. HINMAN,
Captain of Engineers.

HIEF OF ENGINEERS, U. S. A.

K 1.

IMPROVEMENT OF HARBOR AT NORFOLK, VIRGINIA.

were no operations during the fiscal year ending June 30, 1886, ls available not being sufficient to justify any. The small amount d during that time was for contingencies.

ondition of the work on June 30, 1886, was as stated in the Anport for 1885, with slight deterioration. The ruling depth is 24 nean low water. This information is necessarily based on a curmination, no survey having been made since that of March and 885.

The easterly side of the cut through Sewall's Point Bar buoyed every 1,200 feet to mark it properly.

The portion of the approach to the harbor between Lambe and Fort Norfolk is not included herein, as it is now a work b

A plan and specifications have been prepared for building a steam tender to replace one that has been chartered for a n years past for use in this district. It will be built in due time for from allotments from this and other works. The estimate $8,000.

The funds available will be applied to contingencies.

The sum of $507,744.56 can be profitably expended in the fis ending June 30, 1888, with which it is proposed to complete provement as projected (for details see Report of the Chief of En 1885), to the great benefit of navigation, commerce, and to the States (Norfolk) navy-yard.

The commercial statistics relative to exports, imports, cot coal are appended hereto. There is no organization that coll tistics relating to truck, oysters, lumber, peanuts, &c., which tainly large.

Norfolk is a port of entry.

Money statement.

July 1, 1885, amount available	$
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	
July 1, 1886, amount available	
Amount appropriated by act approved August 5, 1886	5
Amount available for fiscal year ending June 30, 1887	5
Amount (estimated) required for completion of existing project	45
Amount that can be profitably expended in fiscal year ending June 30, 1888	45

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

Statistics relative to port of Norfolk, Va., for the fiscal year ending June 30, 1886 *from W. R. Mayo, esq., collector.*

Articles.	Quantities.	Values.	Articles.	Quantities.
IMPORTS.			EXPORTS—continued.	
Salt .... pounds..	19,614,527	$42,744	Shingles .... number..	545,300
Superphosphate ... tons..	900	11,096	Poplar plank ...... do....	1,830
Kainit .... do...	999	7,232	Shuttle blocks ..... do....	30,000
Guano .... do...	1,054	61,514	White-oak spokes.. do....	6,590
Coal .... do...	255	520	Plank.............. do....	759
Potatoes .... bushels..	11,091	2,115	Boat .... do....	1
Wine .... gallons..	852	597	Church bell .... do....	1
Olive oil .... do....	10	4	Grindstones .... do....	390
Coffee .... pounds..	170	17	Cartridges......... do....	2,000
Maccaroni .... do....	100	5	Muskets........... do....	2
Works of art............	....	1,465	Cotton ties......... do....	37,000
Cotton-plush frames......	....	49	Coal .... tons..	25,964
Conch shells	....	3	Manganese .... do...	334
Olives..................	....	30	Pyrites .... do...	259
			Corn .... bushels..	53,021
Total	....	127,391	Bark .... bags..	4,951
			Grain bags ..... number..	5,975
EXPORTS.			Tobacco .... pounds..	107,729
			Pine plank .... feet..	356,565
Cotton .... bales..	245,606	11,167,860	Shuttle blocks .... cases..	431
Staves .... number..	4,510,443	230,561	Wine .... gallons..	10
Logs............... do ...	6,716	73,240		
W. O. plank........ do....	8,324	28,562	Total...............	....

LETTER OF THE NORFOLK AND PORTSMOUTH COTTON EXCHANGE.

NORFOLK AND PORTSMOUTH COTTON EXCHANGE,
Norfolk, Va., July 13, 1886.

R SIR: Herewith please find statement receipts and shipments of cotton at the f Norfolk for twelve months ending 30th June, 1886.

RECEIPTS.

	Bales.
ed at Norfolk, 12 months. ending 30th June, 1866	562,053

SHIPMENTS.

	Bales.	
ted direct to Great Britain	235,402	
ted direct to France	2,328	
ted direct to the Continent	7,878	
›tal exports		245,608
wise—New York, Boston, Providence, Baltimore, and Philadelphia		310,867
Total shipments twelve months, 30th June, 1886		556,475

e the organization of our exchange in 1874 there have been received and d to 30th June following number of bales of cotton:

	Bales.
›ts twelve years to 30th June, 1886	6,671,379
ents twelve years to 30th June, 1886	6,660,672

I remain, dear sir, yours, very truly,

NORMAN BELL,
Superintendent and Secretary.

t. F. A. HINMAN,
Corps of Engineers, U. S. A.

MENT OF RECEIPTS AND SHIPMENTS OF COTTON AT THE PORT OF NORFOLK, VIRGINIA.

NORFOLK AND PORTSMOUTH COTTON EXCHANGE,

report will be found 6,137 bales which have been ferried to Norfolk an through our custom-house.

Norfolk has handled ....
West Point has handled..
Newport News has handled..

Total handled at three Virginia ports............................

The receipts and shipments of cotton at the port of Norfolk for the twel ending August 31, 1885, are as follows:

RECEIPTS.

Route.		Through.	Local.
Norfolk and Western Railroad		85,676	140,397
Seaboard and Roanoke Railroad		60,647	158,024
Norfolk Southern Railroad		11,505	41,067
Chesapeake and Ohio Railroad		6,137	614
Albemarle and Chesapeake Canal		3,810	43,693
Dismal Swamp Canal		....	757
Nansemond and James Rivers, &c		....	2,633
Total receipts for Norfolk		167,775	387,185
Deduct received from Wilmington	2,384	8,521	....
Deduct received from Newport News	6,137		
Deduct received from Mobile, Ala	800	....	1,021
Deduct received from Charleston, S. C	221		
Receipts at Norfolk		159,254	386,164

RECEIPTS IN ELEVEN YEARS.

	Through.	Local.
Receipts season 1884-'85	159,254	386,164
Receipts ten years previous	2,815,495	2,751,332
Receipts in eleven years	2,974,749	3,137,496

EXPORTS AND SHIPMENTS.

The direct exports, coastwise shipments, and other details of the distributio movement are as follows:

Exported direct to Great Britain since September 1, 1884		2
Exported direct to France		
Exported direct to Continent		
Total direct foreign exports		2
Coastwise movement:		
New York	90,846	
Boston	74,506	
Providence	31,172	
Baltimore	46,571	
Philadelphia	13,301	
Liverpool, via Newport News	593	
Total coastwise shipments		25
Total shipments		55
Withdrawn for consumption since February 1, 1885	642	
Burned February 25, 1885	1,968	
Shipped overland to Petersburg and Suffolk	399	
Total distribution		55

RECAPITULATION.

	B
By stock on hand August 31, 1884	
By total receipts 12 months ending August 31, 1884	55

	Bales.
direct exports	295,817
coastwise shipments	256,989
nsumption, burned and overland	3,009
ock on hand August 31, 1885	125
Total	555,940

llowing is a summary of the exports and shipments from this port for the past n years:

	Foreign.	Coastwise.	Total.
ments, 12 months August 31, 1885	295,817	256,989	552,806
ments, 10 years ending August 31, 1884	2,187,083	2,367,894	5,554,977
Total	2,482,900	2,624,883	6,107,783

e value of our direct exports for season 1884-'85 amount to $14,279,835, an increase 597,010 over the season of 1883-'84, and for the past seven seasons are as follows:

Season.	Bales.	Value.
-'79	[illegible]	$9,143,015
-'80	[illegible]	12,785,209
-'81	[illegible]	17,286,947
-'82	321,817	17,572,410
-'83	372,539	17,969,682
-'84	243,341	11,682,825
-'85	295,817	14,279,835

ere have been shipped on through bills of lading to Great Britain and the Conti-, via Boston, New York, Philadelphia, and Baltimore, 65,917 bales, exclusive of bales shipped via Newport News to Liverpool. These shipments do not appear r exports, being credited at port where finally cleared.

e shipments via coastwise lines on through bills of lading for the past seven sea- have been as follows:

Season.	Bales.	Season.	Bales.
-'79	30,270	1882-'83	91,288
-'80	25,614	1883-'84	82,818
-'81	40,873	1884-'85 65,917 Liverpool via Newport News 593	66,510
-'82	42,749		

Through the courtesy of P. H. Adams, Esq., General C. and F. Agent at West Point, a., I am enabled to give the receipts and shipments of cotton at that port.

ceipts at West Point, Va., twelve months ending August 31, 1885		211,753
xported to Great Britain (Liverpool)	12,762	
xported to continent	13,895	
Total direct exports		26,657
astwise shipments:		
New England towns	26,636	
New York	105,728	
Philadelphia	12,411	
Baltimore	40,294	
Returned home	27	
Total domestic movement		185,096
Total amount, West Point		211,753

Through the published figures I am enabled to give following statement of move-ent of cotton at Newport News for twelve months ending August 31, 1885, and to on. Baker P. Lee, collector of customs, I am indebted for the official exports of cot-n for same period:

ss receipts at Newport News for twelve months ending August 31, 1885	59,316
ss cotton direct for Norfolk and ferried to destination	614
Net receipts, Newport News	58,702

DISTRIBUTION.

Exported direct to Liverpool, as per custom-house returns..............
Ferried to Norfolk, for export to Liverpool..................................
Shipped to coastwise ports, New England towns, &c ....

Total...

I desire to express my appreciation of the courtesies extended this office cials and their representatives of the various transportation lines, and al orable collector of the port.

I remain, dear sirs, very respectfully, your obedient servant,

NORMAN B
Superintendent and S

The PRESIDENT AND BOARD OF DIRECTORS,
Norfolk and Portsmouth Cotton Exchange.

Statement of Pocahontas semi-bituminous coal delivered at Lambert's Point Pie folk, Va., from July 1, 1885, to June 30, 1886.

Month.	Steamers loaded or supplied.			American sailing vessels loaded.					Total vessels.	Tons of coal shipped or su			
	British.	Spanish.	Norwegian.	Ships.	Barks.	Barkentines.	Brigs.	Schooners.		Foreign.	Coastwise.	Steamers.	Local.
July	....	....	....	1	....	....	....	43	44	*2,501	24,536	....	1,86
August	....	....	....	....	....	....	1	42	43	601	28,853	....	2,37
September	2	1	....	....	....	....	1	39	43	480	24,633	638	2,22
October	8	....	....	....	....	....	1	44	53	159	27,324	1,899	4,06
November	6	....	....	....	....	....	....	40	46	....	26,862	1,579	4,51
December	11	....	....	....	....	1	1	42	55	2,184	25,956	2,882	3,72
January	7	....	....	....	....	2	....	37	46	2,430	24,233	1,402	4,17
February	4	1	....	....	....	....	1	17	23	2,274	10,314	1,207	3,78
March	11	....	....	....	....	1	1	49	62	1,691	37,842	3,131	6,16
April	8	1	1	....	1	....	....	51	62	408	43,356	2,422	6,21
May	3	2	....	....	....	....	2	48	55	2,291	40,023	1,363	6,67
June	2	....	....	....	1	1	3	43	50	1,984	28,491	477	3,85
Total	62	5	1	1	2	5	11	405	582	17,003	342,423	17,000	49,62

* Cargo of ship John Bryce shipped to San Francisco, Cal.
† Changing gauge of Norfolk & Western railroad affected receipts temporarily.

WILLIAM LAMB & CO.,
Agents of Castner & Co., Limite
Norfolk, Va., June 30,

Capt. F. A. HINMAN,
Corps of Engineers, U. S. A.

K 2.

IMPROVEMENT OF APPROACH TO NORFOLK HARBOR AND THE U STATES (NORFOLK) NAVY-YARD BETWEEN LAMBERT'S POIN FORT NORFOLK, VIRGINIA.

The act of July 5, 1884, appropriated $50,000 specifically to the channel of this portion of Elizabeth River. A Board of En Officers was convened August, 1884, to prepare a project for the a tion of this appropriation, and submitted reports thereon. (For

Report of the Chief of Engineers, 1885.) The Board reported a plan olving, in conjunction with dredging, the construction of a dike at near Pinner Point, expressing at the same time doubts whether, un- r the phraseology of the law, any part of the money could be applied a work of construction.

However, the requirements of navigation demanding the widening of e channel as contemplated in the project already commenced and partly ecuted by dredging, it was recommended that the existing appropria- n be applied to widening the channel between Lambert's Point and rt Norfolk by dredging along the eastern side thereof.

This having been duly approved, proposals were invited for dredging accordance therewith, and on August 12, 1885, a contract was entered to with P. Sanford Ross, esq., the lowest bidder, to do the work at cents per cubic yard, measured in scows.

Mr. Ross began work October 1, 1885, and completed it December 22, 85, nine days sooner than the least time (three months) allowed by e contract for its execution. He removed 469,944 cubic yards of ma- ial, about 300,000 cubic yards of which was deposited on Craney Isl- d Flats and the balance in Willoughby Bay.

This work has resulted in a straight channel at least 25 feet deep and t less than 400 feet wide at mean low water the entire length of this proach, which formerly had an angle in it.

It has given greater safety and ease to navigation, and promoted and ilitated commerce, trade, the postal service, and the business relating the navy-yard.

The easterly side of the channel should be buoyed every 1,200 feet to rk it properly.

A plan and specifications have been prepared for building a steam ler for use on this and other works. For details relative thereto see ort for this fiscal year on harbor at Norfolk, Va., and its approaches.

The funds available will be applied to contingencies. The sum of 55,600 can be profitably expended in the fiscal year ending June 30, 88, with which it is proposed to complete the improvement as pro- ected (for details see Report of the Chief of Engineers, 1885,) to the eat benefit of navigation and commerce, and also the United States orfolk) navy-yard.

For commercial statistics see report of this fiscal year on harbor at orfolk, Va., and its approaches, of which this is a part.

Norfolk is a port of entry.

Money statement.

ly 1, 1885, amount available	$49,618 64
ount received from an officer for fuel	38 25
	49,656 89
ly 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	46,806 89
ly 1, 1886, amount available	2,850 00
ount appropriated by act approved August 5, 1886	137,500 00
ount available for fiscal year ending June 30, 1888	140,350 00

Amount (estimated) required for completion of existing project	118,100 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	118,100 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

Abstract of proposals received for dredging approach to Norfolk Harbor and States (Norfolk) navy-yard, opened by Capt. F. A. Hinman, Corps of Engine folk, Va., August 7, 1885.

No.	Names and addresses of bidders.	Date of commencement and completion of work.	Number and kind of machines to be used.	Capacity (cubic
1	Daniel Constantine, president Baltimore Dredging Company, Baltimore, Md.	Commence work about October 15, 1885, and complete same on or about January 1, 1886.	A sufficient number of clam-shell dredges.	.....
2	American Dredging Company, Isaac Albertson president, Philadelphia, Pa.	According to specifications.	All necessary machinery and appliances.	.....
3	Morris & Cumings Dredging Company, by Joseph Cumings president, New York, N. Y.	Commence work within forty days and complete same by January 1, 1886.	Two or more clam-shell machines.	4,0
4	Rittenhouse Moore, Mobile, Ala.	According to specifications.	One large clam-shell dredge.	4,0
5	P. Sanford Ross, Jersey City, N. J.	Commence work October 1, 1885.	Two large clam-shell dredges.	4,0
6	National Dredging Company, George G. Barker treasurer, Wilmington, Del.	Commence work on or before October 1, 1885.	Two or more grapple dredges.	4,00
7	New York Steam Dredging Company, S. F. Shortland president, New York, N. Y.	Commence work on or before October 1, 1885, and complete same on or before January 1, 1886.	Two large clam-shell dredges.	4,00

Contract with P. Sanford Ross.

K 3.

IMPROVEMENT OF APPOMATTOX RIVER, VIRGINIA.

The operations during the fiscal year ending June 30, 1886, we fined to Puddledock Cut.

The contract with A. F. Hall, esq., referred to in the last Ann port, was duly extended to and completed on January 15, 188 Hall removed 70,124 cubic yards of material, measured in plac ing a total of 121,424 cubic yards removed under his contract.

Seven pile and brush revetments, aggregating 940 linear fee built by hired labor, the purchase of material in open market, use of the United States plant, to sustain the dredge bank a points on the westerly side of the cut.

The foregoing has resulted in materially widening and deepen channel along the entire length (about 2 miles) of the westerly Puddledock Cut, and also along 1,250 linear feet of the easter thereby subserving navigation and commerce. The navigable c through this cut is not less than 60 feet wide at bottom and at 1 feet deep at high water.

The condition of the work on June 30, 1886, was good. Ther navigable channel at least 12 feet deep at mean high water, exc few points where short shoals have formed with 11 feet thereon l that this is due either to the untimely departure or arrival of , or to the overloading or careless handling of them, which causes ground and form shoals. This practice should of course be dis- ed.

utlet into Old Channel will be closed as soon as Puddledock Cut leted; this will tend to remove the shoal that forms in that vi- t Jetty 22.

mall balance available will be applied to the care of property tingencies. The sum of $46,000 can be profitably expended in al year ending June 30, 1888, with which it is proposed to com- e improvement as projected, to the great benefit of navigation nmerce. It is estimated that $5,000 will be required yearly there- maintain the work, parts of which are of a temporary character l need repairs.

ommercial statistics are appended hereto.

sburg is a port of entry.

Money statement.

885, amount available		$10,437 09
886, amount expended during fiscal year, exclusive ilities outstanding July 1, 1886	$9,519 79	
866, outstanding liabilities	60 00	
		9,579 79
886, amount available		857 30
appropriated by act approved August 5, 1886		18,750 00
available for fiscal year ending June 30, 1887		19,607 30
t (estimated) required for completion of existing project		27,250 00
t that can be profitably expended in fiscal year ending June 30, 1888		27,250 00

tted in compliance with requirements of section 2 of river and or acts of 1866 and 1867.

COMMERCIAL STATISTICS.

PETERSBURG, *July* 14, 1886.

SIR: In compliance with your request of June 28 last, I hereby furnish you l information of the tonnage and commerce of the port of Petersburg for l year 1885–1886. Table A represents the tonnage of the port for the period Table B shows the articles of freight received at or sent from the port by ppomattox River, with the values thereof, at the city of Petersburg during ending June 30, 1886.

E A.—*Tonnage of the port of Petersburg, from July* 1, 1885, *to July* 1, 1886.

Class.	Vessels.	Tonnage.
	220	24,962 56
	58	605 79
s	345	4,075 18
	321	39,192 13
l	953	68,835 66

TABLE B.—*River commerce of the port of Petersburg.—Value of articl*

INWARD FREIGHT.

Articles.	Value.	Articles.
Coal	$77,420	Peanuts
Corn	9,111	Potatoes
Oats	936	Oil
Wheat	430	Bricks
Hay, straw, &c	1,576	Cabbages
Ice	32,604	Sumac
Guano	219,312	Lumber, pine
Lime, builder's	1,620	Lumber, white pine
Lime, shell	1,000	Oysters
Salt, Liverpool and G. A	1,001	Miscellaneous
Cotton ties	14,426	
Cotton	65,505	Total

OUTWARD FREIGHT.

Barrels	$994	Lumber, pine
Cotton	42,350	Wood, pine
Cotton seed	420	Wood, poplar
Gas tar	1,449	Miscellaneous
Guano	14,480	
Stable manure	279	Total

SUMMARY.

Inward commerce
Outward commerce

Total

The past fiscal year, like the one immediately preceding, proved to
trade, and whilst Table A will show an increase in the tonnage of t
pared with that of 1884–1885, there has been considerable falling off i
by the river.

In my last annual report it was stated that negotiations were pending
of certain rocks in the harbor, and it is a matter of satisfaction to co
fact of the accomplishment of this work, a depth of 12 feet at low ti
made at the three points where the said rocks existed; and the b
spring freshets in the basin cut out by the Government some time a
out by the city in June, but which has since been formed again by th
that has occurred in the Appomattox Rixer for about thirty-five yea
a foot below the height attained by the great freshet of March, 1851;
will no doubt be again cleared away this summer.

The city has likewise carried on dredging operations during the
moval of bars at the Magazine Reach, near the corporation line, and
Puddledock Cut, which obstructed the navigation no little and tend
commerce of the port; and this last-named bar has formed again and is
part of the entire channel at this date. Now the original scheme of a
nel-way of 12 feet at mean high tide is most anxiously looked for to be
at an early day, which will be sure to augment the tonnage and comme
and prove to be the dawning of an auspicious era in the commercial hi
burg.

The following statistics are taken from the official records of the U
ternal revenue department of Petersburg for the year 1885.

Tax collected from tobacco manufactured in Petersburg
Tobacco manufactured in Petersburg, exported pound

Very respectfully,

E. H. St

Capt. F. A. HINMAN,
Corps of Engineers, U. S. A.

K 4.

IMPROVEMENT OF NOTTOWAY RIVER, VIRGINIA.

ere were no operations during the fiscal year ending June 30, 1886. as deemed inexpedient to resume them, the funds available being ficient. The small amount expended during that time was for con-
encies.

ere are no reliable commercial statistics available. There is but traffic over the river. No further appropriation is asked for this r.

s river is in the collection district of Norfolk, Va.

Money statement.

1, 1885, amount available	$453 29
1, 1886, amount expended during fiscal year, exclusive of liabilities standing July 1, 1885	207 13
1, 1886, amount available	246 16

K 5.

IMPROVEMENT OF BLACKWATER RIVER, VIRGINIA.

ere were no operations during the fiscal year ending June 30, 1886, e being no funds available.

e sum of $2,500 can be profitably expended in the fiscal year end- June 30, 1888. It is proposed to apply this as follows:

dredging two bars that have shoaled slightly, cutting off project- points that have only been partially cut off, and removing any , snags, &c., that may be found.

e commercial statistics are appended hereto.
s river is in the collection district of Norfolk, Va.

Money statement.

ount that can be profitably expended in fiscal year ending June 30, 1888	$2,500 00
mitted in compliance with requirements of section 2 of river and har- or acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

ess delivered to and from points on Chowan, Blackwater, and Meherrin rivers, by Albemarle Steam Navigation Company, from July 1, 1885, to July 1, 1886.

Articles.		North.	South.
andise	pounds	5,285,958	11,902,768
	do		4,206,840
	bales	12,872	
fresh	boxes	2,780	
alt	barrels	4,006	

usiness from Nottoway River.

J. H. BOGART,
Superintendent Albemarle Steam Navigation Company.

t. F. A. HINMAN,
Corps of Engineers, U. S. A.

K 6.

IMPROVEMENT OF ARCHER'S HOPE RIVER, VIRGINIA.

There were no operations during the fiscal year ending June
It was deemed inexpedient to resume them, the funds availa
insufficient. The small amount expended during that time wa
tingencies.

The amount that can be profitably expended in the fiscal yea
June 30, 1888, is $9,400.70. This will be applied to dredging
complete the project.

No reliable commercial statistics are available. However,
unimportant.

This river is in the collection district of Yorktown, Va.

Money statement.

July 1, 1885, amount available..

July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885..

July 1, 1886, amount available..

Amount (estimated) required for completion of existing project........
Amount that can be profitably expended in fiscal year ending June 30, 1888
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

K 7.

IMPROVEMENT OF NORTH LANDING RIVER, VIRGINIA AND N CAROLINA.

There were no operations during the fiscal year ending June 3
It was deemed inexpedient to resume them, the funds availabl
insufficient. The amount expended during that time was for
gencies and the construction of a combined steam hoister a
driver for use on this work, and also on the Pamplico and Ta
For the details relative thereto, see report for this fiscal year
latter.

The funds available will be applied to contingencies. The
$10,000 can be profitably expended in the fiscal year ending J
1888. It is proposed to apply this to dredging, as set forth in t
nual Report of the Chief of Engineers, 1885, and also to the rem
logs, &c., that have made their appearance since the river w
cleared of them. The most of this is due to the careless hanc
log-rafts, for which there should be some remedy.

The commercial statistics received from the Albemarle and
peake Canal Company are appended hereto. They also relate
rituck Sound, Coanjok Bay, and North River Bar, which are
same inland water route.

This river is in the collection district of Norfolk, Va.

Money statement.

ly 1, 1885, amount available	$1,701 28
ly 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	201 28
ly 1, 1886, amount available	1,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	10,000 00

ubmitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

de through the Albemarle and Chesapeake Canal for fiscal year ending June 30, 1886, passing through Elizabeth and North Landing rivers.

GOING NORTH.

Articles.	Quantity.	Articles.	Quantity.
ton ....bales..	58, 478	Rice ....bushels..	29, 688
h..........barrels..	1, 609	Wheat ....do....	3, 060
al stores..........do ...	2, 576	Peanuts..........bags..	4, 924
..........pounds..	2, 250	Lumber ....feet..	70, 885, 312
iron..........do....	6, 400	Railroad ties..........number..	10, 283
m..........do....	24	Watermelons..........do....	296, 946
..........crates..	1, 990	Shingles..........do....	26, 106, 488
d ....cords..	222	Staves..........do....	496, 102
s and beans..........bushels..	4, 513	Laths ....do....	738, 075
atoes ....do....	54, 041	Passengers..........do....	1, 752
n ....do....	97, 628		

GOING SOUTH.

Articles.	Quantity.	Articles.	Quantity.
ad ....barrels..	49	Soap and candles..........boxes..	127
f and pork..........do....	8, 400	Tobacco..........do....	482
ler and beer..........do....	6	Ware ....crates..	17
ur ....do....	33, 537	Lime and cement..........casks..	888
h..........do....	538	Oyster shells..........bushels..	54, 155
lasses ....do....	645	Agricultural lime..........do....	85, 475
irits ....do....	529	Iron..........pounds..	640, 420
gar ....do....	2, 656	Hay ....bales..	11, 447
l..........do....	2, 384	Guano.......... tons..	4, 783
ffee ....sacks..	319	Coal..........do....	8, 552
lt ....do....	8, 266	Ice ....do....	1, 561
ts and shoes..........cases..	119	Passengers ....number..	1, 589
ails..........kegs..	388		

K 8.

IMPROVEMENT OF EDENTON BAY, NORTH CAROLINA.

The operations during the fiscal year ending June 30, 1886, were confined to dredging.

The contract with Thomas P. Morgan, esq., referred to in the last Annual Report, was completed August 27, 1885. The total quantity of material removed under it is 46,043 cubic yards, measured in situ; deducting therefrom the approximate estimate, 29,000 cubic yards, removed last year, leaves 17,043 for this year. Four hundred and ninety pounds of No. 2 dynamite was purchased in open market and used here by the Government in blasting stumps, &c., to facilitate dredging.

The accompanying map of the last survey of this locality, made September 7–10, 1885, shows that the work has resulted in a channel, the entire length and depth projected, 150 feet wide at the outer end and 165 feet wide at the inner end, with a triangular turning-basin midway of 9½ acres. The total area dredged here is 17½ acres; and the total 9 feet deep and upward at ordinary low water, 18¾ acres. There is a naviga-

ble channel of varying width at least 10 feet deep, at sam
entire length of the harbor.

The funds available will be held for contingencies. Th
the estimate required for the completion of the adopted proje
but no further appropriation is asked for at present as Edenton
bor amply sufficient for all the present wants of navigation
merce, which, so far as can be forecast, will suffice for some ti
It is probable that dredging will be required at long intervals,
has a tendency to silt slowly.

The commercial statistics received from M. K. King, esq., ge
ager of the Norfolk Southern Railroad, are appended hereto.
more of minor importance, but they could not be obtained.

Edenton is in the collection district of Albemarle, N. C.

Money statement.

July 1, 1885, amount available ....
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885 ....

July 1, 1886, amount available ....
Amount appropriated by act approved August 5, 1886....................

Amount available for fiscal year ending June 30, 1887 ....

Amount (estimated) required for completion of existing project........
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

[Norfolk Southern Railroad Company, General Manager's Office.]

NORFOLK, VA., *July* 13,

DEAR SIR: Inclosed please find the statistics requested in your letter of J
Very truly,

M. K. KING,
General Ma

Capt. F. A. HINMAN,
Corps of Engineers, U. S. A.

Character and quantity of freight north bound from Roanoke River, Edenton, and S nong River, transported by Norfolk Southern Railroad from July 1, 1885, to July

Articles and tonnage.	Edenton and Roanoke River.	Scuppernong River.	Articles and tonnage.	Edenton and Roanoke River.	
ARTICLES.			ARTICLES—continued.		
Lumber..............feet..	280,100	7,634	Staves........number..	11,969	...
Corn............bushels..	168	7,091	Shingles..........do....	200,350	...
Rice................do....	1,842	6,230	Barrel heads......do....	99,459	...
Truck.........packages..	9,994	3,151	Sheep and hogs...do....	27	
Fish, fresh........boxes..	5,216	496	Peanuts....... bushels..	19,828	
Fish, salt........barrels..	1,782	240	Logs ....feet..	2,982,026	
Tar and rosin.......do....	97	....	TONNAGE.		
Cotton.............bales..	12,649	1,793			
Melons... ....number..	15,040	....			
Cattle..............do....	40	364	North bound..............	30,738,472	2,
Poultry ....crates..	69	856	South bound..............	13,171,945	2,
Eggs...............do....	1,092	1,989			
Merchandise ..packages..	3,914	1,501	Total..............	43,910,417	5,

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K 9.

PROVEMENT OF CURRITUCK SOUND, COANJOK BAY, AND NORTH RIVER BAR, NORTH CAROLINA.

There were no operations during the fiscal year ending June 30, 1886. was deemed inexpedient to resume them, the funds available being fficient.

The channel has deteriorated some, due very largely, it is thought, to mers grounding out of it and creating shoals in their efforts to get Buoys or piles maintained constantly between the gas-beacons to k the channel would tend to diminish this.

A plan and specifications have been prepared for building a steam- der for use on this and other works. For the details relative thereto, report of this fiscal year on harbor at Norfolk and its approaches, ginia.

The funds available will be applied to contingencies. The sum of ,122.85 can be profitably expended in the fiscal year ending June 30, It is proposed to apply this to dredging, as set forth in the An- l Report of the Chief of Engineers, 1885.

The commercial statistics are the same as those to be found in report North Landing River for this fiscal year, these works being on the inland water route.

Currituck Sound, Coanjok Bay, and North River Bar are in the collection district of folk, Va.

Money statement.

y 1, 1885, amount available	$1,500 00
y 1, 1886, amount available	1,500 00
ount appropriated by act approved August 5, 1886	10,000 00
ount available for fiscal year ending June 30, 1887	11,500 00
Amount (estimated) required for completion of existing project	55,122 85
Amount that can be profitably expended in fiscal year ending June 30, 1888	55,122 85
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

K 10.

IMPROVEMENT OF MEHERRIN RIVER, NORTH CAROLINA.

There were no operations during the fiscal year ending June 30, 1886. It was deemed inexpedient to resume them, the funds available being insufficient to do necessary dredging. The small amount expended during that time was for contingencies. The balance available will doubtless be required in due time to remove logs, snags, &c., that will have again formed obstructions.

The sum of $7,500 can be profitably expended in the fiscal year ending June 30, 1888. It is proposed to apply this to dredging and the removal of obstructions like those above that will continue to form.

A portion of the commercial statistics will be found in report for this fiscal year on the Blackwater River. There are more, as other lines of boats ply here, but they could not be obtained.

The Meherrin River is in the collection district of Norfolk, Va.

Money statement.

July 1, 1885, amount available....................................
July 1, 1886, amount expended during fiscal year, exclusive of liabili
outstanding July 1, 1885....................................

July 1, 1886, amount available....................................

Amount (estimated) required for completion of existing project....
Amount that can be profitably expended in fiscal year ending June 30,
Submitted in compliance with requirements of section 2 of river
harbor acts of 1866 and 1867.

K II.

IMPROVEMENT OF PAMPLICO AND TAR RIVERS, NORTH

The combined steam-hoister and pile-driver referred
Annual Report was completed for use on this work and N
River. The cost of this as per original specifications
Extras, in the shape of outfit, &c., were added, making the c
From August 19 to October 31 it was engaged in removing
and thoroughly cleared the river of them between Wa
Greenville. (The portion worked over is the first 6½ miles
ville.) It is well adapted to the work. Six hundred and
obstructions were removed and burnt, so that they can nev
the river during freshets as obstructions. They consist
lowing: 2 sunken flats, 29 floating logs, 228 sunken log
trees, 25 stumps, 249 snags, and 22 overhanging trees.

An examination of the river was made, which shows
following condition: Of the forty-one jetties twenty-five
order, and the balance not. As a rule they have proved
navigation, but more will be required to complete the p
have been damaged by steamers striking them at high wa
reason piles should be placed at the ends thereof to mar
best jetties are those composed of two rows of piles, filled
&c. No work has been done on jetties since 1882. There
overhanging trees along this river, and many logs, snags,
moved. The bridges at Greenville and Sparta collect la
of drift, which causes shoals and rapids to form to the detri
gation. Clear span-bridges should be substituted theref
run regularly from Washington to Greenville the year roun
to Tarborough only during high water.

The foregoing was done by the hire of labor, the purcha
in open market, and the use of the United States plant.

The small balance available will be applied to the ca
and contingencies.

The sum of $5,000 can be profitably expended in the fi
ing June 30, 1888. It is proposed to apply this to the re
snags, shoals, &c., and the repair and construction of jett

The commercial statistics, collected from three steamsh
&c., by Mr. F. B. Satchwell, Washington, N. C., are app
There are more of minor importance, but they could not

These rivers are in the collection district of Pamplico, N. C.

Money statement.

1885, amount available	$2,462 90
1886, amount expended during fiscal year, exclusive of liabilities nding July 1, 1885	2,414 23
1886, amount available	48 67
t appropriated by act approved August 5, 1886	5,000 00
t available for fiscal year ending June 30, 1887	5,048 67
nt that can be profitably expended in fiscal year ending June 30, 1888 itted in compliance with requirements of section 2 of river and rbor acts of 1866 and 1867.	5,000 00

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	Quantities.	Articles.	Quantities.
feet	8,317,444	Potatoes barrels	6,415
number	2,887,825	Merchandise packages	11,192
do	111,300	Peas bags	208
bales	27,804	Green hides number	38
bushels	17,000	Balusters do	41,950
ierces barrels	6,140	Tonnage tons	807,165

K 12.

IMPROVEMENT OF YADKIN RIVER, NORTH CAROLINA.

erations were resumed August 15 and suspended November 21.
water greatly interfered with the work. It was unusually high sev-
mes during the year. The work consisted in extending the channel,
nter stage, around the north end of Swicegood's Mill-dam and into
ool above it, without injuring the water-power, but on the contrary
ving it incidentally. This was accomplished by executing the fol-
g in addition to that given in the last Annual Report: Six wing-
, aggregating 356 linear feet, and two sill-dams, 60 linear feet each
built; one wing-dam was extended 5 linear feet; the training-wall
xtended 125 linear feet above the mill-dam; 150 linear feet of train-
all and 498 linear feet of wing-dams, built in 1884, were raised and
gthened, and several rock ledges removed.

the prosecution of the above, 325 linear feet of holes were drilled,
wo hundred and seventy-five blasts made, using 615 pounds of No.
namite. The following material was consumed by the work: 445
yards of rock, 300 cords loose brush, twenty-seven brush mat-
s, 20 feet long, 10 feet wide, and 1½ and 2 feet thick, and thirty-
logs.

e foregoing was done by the hire of labor, the purchase of material
en market, and the use of the United States plant.

e condition of the work on June 30, 1886, was excellent, it being
ery permanent nature. The plant generally has been in use since
ll of 1880. It has received current repairs as needed, but will
re extensive repairs and renewals ere long.

The act of July 5, 1884, provided as follows:

> That the sum of $6,000, authorized by the act approved June 14, 1880
> pended for the removal of dams in Yadkin River, North Carolina, may be u
> Secretary of War for acquiring the right of way, by removal or otherwi
> dams as may be necessary for the contemplated improvement, the said ri
> or removal to be obtained by agreement with the parties interested, or, i
> failure to make a reasonable agreement, by condemnation, as provided for b
> of the State of North Carolina.

It is questionable whether the expenditure of any of this sun
necessary, as recent investigations show that the dams can all
and most economically passed by wing-dams and training-wal
locks, as the case may be. Accordingly, this amount will be
the present. It would be very expensive to make low-water na
on this river in any manner; the commerce to be developed wo
justify it.

On June 20, 1885, the Chief of Engineers approved the recon
tion made in the project submitted January 6, 1885, that the ba
the funds available, aside from the $6,000 reserved for acqui
right of way by removal or otherwise of dams, be applied to im
the river at Swicegood's Mill Dam, Dutchman's Island, Boone
Shoal, reef below Fulton, Peebles' Dam, Peebles' Reef, and H
Dam, in the order named, for navigation at *winter stage.* The
available will be applied accordingly, as heretofore.

The sum of $10,000 can be profitably expended in the fisc
ending June 30, 1888. It is proposed to expend this in lengtheni
further improving the channel at winter stage.

No commerce existed upon the river before the commencemen
improvement, and none has been developed thus far. The com
statistics, furnished by Mr. Frank Brown, overseer, are appended.

This river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1885, amount available	$1
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	
July 1, 1886, amount available	
Amount appropriated by act approved August 5, 1886	1
Amount available for fiscal year ending June 30, 1887	1
Amount that can be profitably expended in fiscal year ending June 30, 1888	1

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

FORK CHURCH, DAVIE COUNTY, N.
July

CAPTAIN: In compliance with your request of the 28th ultimo, I have the
make the following statement in reference to the commercial statistics of tha
of country lying along and contiguous to the Yadkin River.

I respectfully state that these statistics have been gathered from my o
(farming, as you know, about 10,000 acres) and from reliable farmers above a
me on the river. Owing to the long-continued rainy season, it is my candi
that one-half of the wheat crop will be lost. Oats unusually good.

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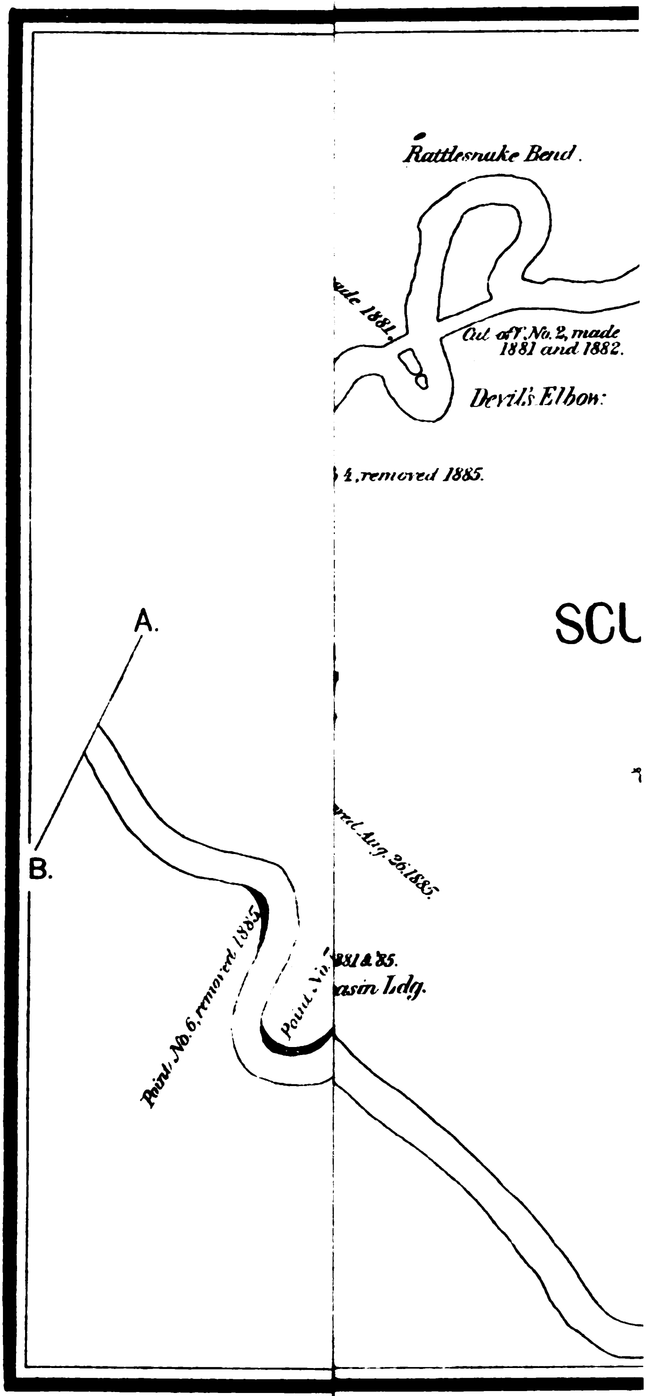

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tural products of above-named section for fiscal year ending Ju

Articles.	Quantity.	Articles.	
....................bushels..	500,000	Oats ....bushels..	
....................do....	101,000	Tobacco......................pounds..	3,
....................do....	5,636	Cotton ....bales..	

y respectfully, your obedient servant,

FRANK BROWN,
Overseer.

. A. HINMAN,
Corps of Engineers, U. S. A.

K 13.

PROVEMENT OF SCUPPERNONG RIVER, NORTH CAROLINA.

operations were resumed July 20, 1885, and completed Sep-
12, 1885. The accompanying map shows where the work was
All dredging was to 9 feet at low water, the details of which are
s:
No. 3 widened 12 feet, making it 100 feet long and 40 feet wide.
No. 4 was made; it is 136 feet long and 40 feet wide.
horoughfare was widened 15 feet, making it 50 feet long and
to 55 feet wide.
points were rounded off; the number of feet removed from each,
d from the point back, is as follows: No. 1, 32 feet; No. 2, 24
3, 22 feet; No. 4, 28 feet; No. 5, 15 feet; No. 6, 17 feet; No.
; No. 8, 18 feet.
rning-basin at the head of navigation was sufficiently enlarged
g off Point No. 1 and dredging an area 15 feet by 40 feet on
site side.
-foot shoal, 650 feet long, at the mouth of Collins Canal (outlet
Phelps) was removed.
egoing was done by the hire of labor and machinery and the
of material in open market, and occupied a dredge 525 work-
. Three hundred and twenty pounds of No. 2 dynamite was
last roots and stumps; the number of blasts made being 129,
ge of about 2.5 pounds to each blast.
eamboat men are greatly pleased with the work, as it has bene-
igation in a very marked manner, by not only shortening the
about half a mile, but also by saving almost endless trouble and
e in pasing bends, permitting larger loads, lessening danger,
g the handling of steamers, &c. So far as can be foreseen
rther work will be required on this river for many years, as it
t that its navigable condition is amply sufficient for the trade

is really no organization that collects commercial statistics.
, two steamers run regularly on the river and do an extensive
ne of them running to Elizabeth City, N. C., under the man-
f the Norfolk Southern Railroad. Other vessels run on the
ionally. The commercial statistics received from M. K. King,

verified the report. Her tonnage was 234, and her
kainit. She had been stripped of everything of
g company.

d by her owner after lawful notice, she was removed
under my personal supervision. The wreck lay on
ed somewhat in the mud, in 14 feet of water at low
on part of her. On June 21 last, 240 pounds of dy-
nitro-glycerine) was divided up and placed close to
s at twelve points. This was fired in two blasts, that
part only. On June 23 last, the forward part was
ns of gunpowder, 100 pounds of which was divided
ar jugs, holding from 20 to 30 pounds each, which
ed, one at a time, by a diver, and fired separately
examination made thereafter showed that the wreck
nger navigation. This work was done at a cost of
ated cost thereof was $500.

Anthea Godfrey.—This wreck was discovered Febru-
ynn Haven Roads, Virginia, in 4½ fathoms of water,
ouse bearing E. by S. ¾ S., distant about 6 miles. The
and there was a question as to the name of the ves-
events have proved almost conclusively that it was
, a schooner of 182 tons, loaded with kainit. She
t date as being a dangerous obstruction to naviga-
e thereafter, February 21 last, a personal examina-
expense to the Government, showed this to be the
company had stripped her of everything of value.
ertised, and not being removed in due time there-
by the Government under my personal supervis-
. She was bottom up, with about 20 feet of water
; by means of a diver 260 pounds of dynamite (40
rine) was distributed along and fastened to her keel
the whole fired simultaneously by electricity. An
thereafter showed that the wreck was completely
d ceased to endanger navigation. This work was
87.37. The estimated cost was $500.

oncord.—This steamer was burned and sunk in the
r Washington, N. C., on February 20 last, on which
this office reported her a dangerous obstruction to
arely covered at low water and near the edge of the
age was 174, and her cargo consisted principally of
ch has been saved and is of little value. Her ma-
th $1,500; her hull is valueless. She has been duly
pense of $6, under the law, the notice being dated
then she has been libeled in the United States dis-
ertised to be sold on July 2, 1886. There will be no
egarding her until the court has finally disposed of
er (if any) has had reasonable time to act thereafter.
work was done by hired labor, the purchase of ma-
et, and the use of the United States plant, that be-
nical and advantageous mode of doing it. It is pro-
wreck of the Concord in a similar manner, if it has
overnment. The estimated cost of so doing is $500.

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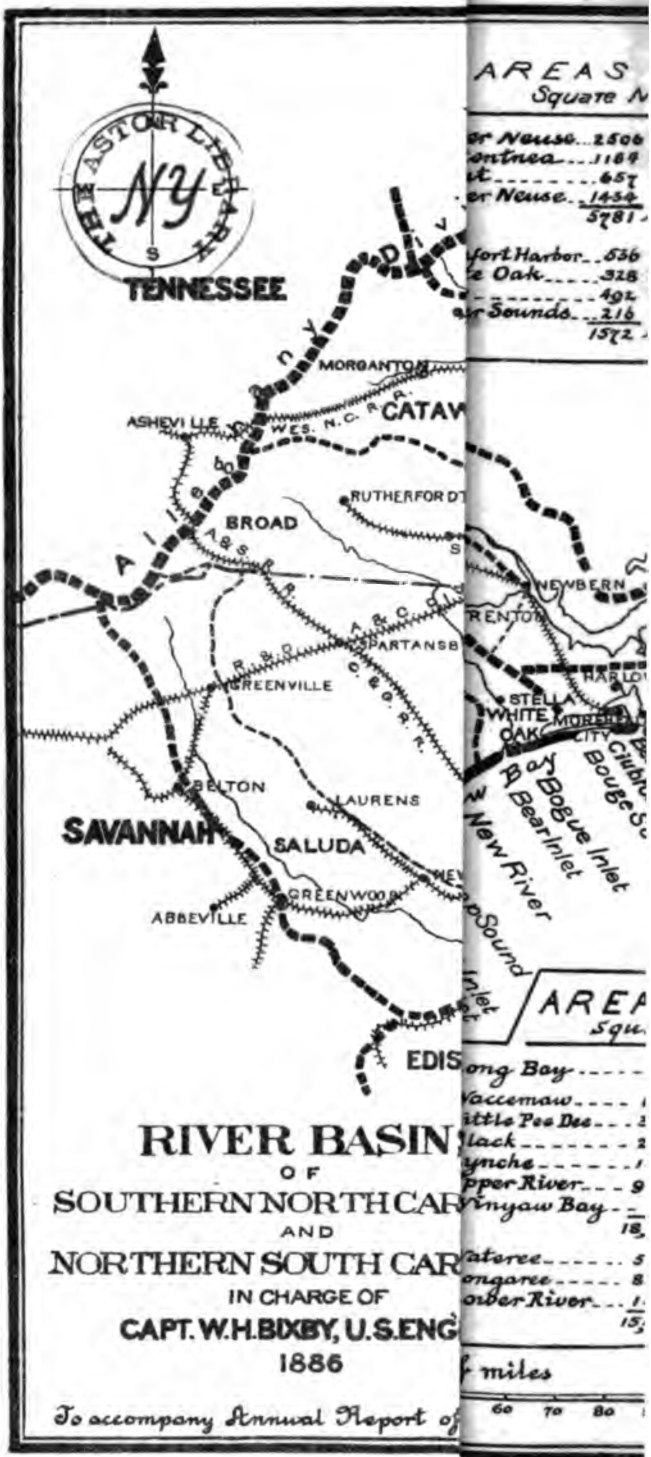

RIVER BASIN
OF
SOUTHERN NORTH CAR
AND
NORTHERN SOUTH CAR
IN CHARGE OF
CAPT. W.H. BIXBY, U.S. ENG
1886

To accompany Annual Report of

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APPENDIX L.

ROVEMENT OF CERTAIN RIVERS AND HARBORS OF NORTH CAROLINA AND SOUTH CAROLINA.

ORT OF CAPTAIN WILLIAM H. BIXBY, CORPS OF ENGINEERS, OF- CER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, WITH HER DOCUMENTS RELATING TO THE WORK.

IMPROVEMENTS.

ontentnea Creek, North Carolina.
t River, North Carolina.
e River, North Carolina.
nd Navigation from New Berne to Beaufort Harbor, via Clubfoot, Har- lowe, and Newport rivers, North Carolina.
bor at Beaufort, North Carolina.
w River, North Carolina.
pe Fear River, above Wilmington, North Carolina.
8. Cape Fear River, below Wilmington, North Carolina.
9. Great Pe Dee River, South Carolina.
10. Waccemaw River, South Carolina.
11. Harbor at Georgetown, South Carolina.
12. Santee River, South Carolina.
13. Wateree River, South Carolina.
14. Removing sunken vessels obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., August 24, 1886.

GENERAL: I have the honor to transmit herewith annual reports the fiscal year ending June 30, 1886, upon the works of river and rbor improvement then in my charge.

Very respectfully, your obedient servant,

WM. H. BIXBY,
Captain of Engineers.

he CHIEF OF ENGINEERS, U. S. A.

L 1.

IMPROVEMENT OF CONTENTNEA CREEK, NORTH CAROLINA.

ontentnea Creek, a tributary of the Neuse River, has a total length bout 144 miles, and a drainage area of 1,184 square miles. This ek, prior to governmental improvement in 1881, had a depth of about et during nine months of the year, from its mouth in the Neuse up- d, about 63 miles, to Stantonsburg, its practical limit of navigation; its channel was completely blocked at all stages of water by sunken

logs and stumps, and by floating obstructions. Its steamboat co
was nothing.

The original project of 1881, as continued to date, proposed for
to secure a safe and unobstructed 3-foot navigation over this en
tance during the high-water season of about nine months. Tl
mate was based on an examination required to be made in grea
at slight expense, and during a time of high freshet. The e
supposed the obstructions to be about 17 sunken trees and 1 st
mile, but actual work has since shown about 45 sunken trees
stumps per mile.

Inadequate yearly appropriations, involving the alternate disor
tion and reorganization of working parties, damage to unfinishe
extra superintendence, and deterioration of plant, have added co
bly to the cost of the work. The aggregate amount appropriated
project up to 30th June, 1886, is $25,000. The present estimat
of 1885), $75,000 for the final cost of the work, is based on the
developments.

Twenty-four thousand six hundred and eighty-seven dolla
sixty-nine cents has been spent in all upon this improvement up
June, 1885, in securing a roughly-cleared 3-foot navigation over
miles from its mouth up to Snow Hill, during the high-water
In consequence of this, a steamboat line has been permanently
lished upon the whole length thus improved, and two steamboat
made bi-weekly trips during nearly nine months each year, to the
benefit of the neighboring country, otherwise without transpo
facilities for its products. The present commerce (including
goods) is rapidly increasing, and is at present about $450,000 of
transported per year; showing that each dollar spent on the im
ment has been accompanied by the development of $18 in annua
merce.

The navigation of this river is obstructed at points, as shown
following extract from special report dated January 17, 1885:

> Between Stantonsburg, the head of present improvement, and Snow Hill, th
> of present navigation there are three county bridges without draws, but there
> yet been no navigation demanding draws. When needed, the draws will un
> edly be put in by the county authorities. I therefore recommend that these
> be permitted, for the present, to remain in their present condition, provide
> their owners will insert suitable draws therein whenever needed by steamers.

The special work of the year is as follows:

Expenditures, $1,419.08.

The amount of money, $1,731.39, available at the commencem
the fiscal year, was too small for economical work; but improve
was so much needed that small immediate actual results were reg
as more valuable than larger, but delayed, possible ones. Owing
variable features and the difficulty of properly specifying it before
and inspecting it afterward, the work was allowably done by hired
and the purchase of materials in open market.

Work was confined to the lower half mile of river, and co
carried on only at low-water stages. Between the 3d Novembe
10th December, during a few days in March, and between the l
April and 31st May, 59 logs, 154 stumps, 68 large snags, 32 cords
snags, 35 cubic yards of earth, 230 linear feet of old sheet-pile d
were removed from the river bed; 86 trees, 32 stumps, and 50
feet of brush were cut and hauled back from 200 feet of river b
342 linear feet of new sheet-pile diking, and 400 linear feet of log

s constructed, and 78 linear feet of old sheet-pile diking were re- ired. Some of the stumps had to be removed by blasting.

All the above work has been well and vigorously carried forward der the immediate supervision of Assistant Engineer R. Ransom.

A brief history of past work upon this improvement has been pre- ed by Assistant Engineer R. Ransom, and is herewith appended.

Recommendations for future work are as follows: That this improve- t be completed in accordance with the present proposed and ap- ved project, so as to secure a thoroughly-cleared 3-foot navigation r the entire river from its mouth 63 miles upward to Stantonsburg ing the nine commercial busy months of the year, at a total expense ,000, in addition to the $312.31 available June 30, 1886; this unt to be appropriated in two yearly installments of $30,000 and ,000, respectively. Smaller appropriations will increase the cost by n $1,000 to $4,000 per appropriation. Further improvement, so as tend this navigation above Stantonsburg, or so as to make the lower r navigable during the low water season, is not recommended at ent.

ter the improvement is finished its proper maintenance may cost n $1,000 to $3,000 per year.

is improvement, as regards cost and order of work, should be car- ied approximately as follows:

enty thousand dollars to secure a fairly-cleared natural channel for n navigation from Snow Hill 32 miles upward to Stantonsburg, moving all dangerous obstructions, such as sunken logs and snags, by cutting down and pulling back from caving banks the trees h would otherwise soon fall into the river. The extension of nav- ion to Stantonsburg will open up the richest part of the Content- Basin and will greatly increase the river commerce.

Ten thousand dollars to dredge and dike the natural channel near river's mouth, so as to keep the water from running off into the adja- t swamps.

Twenty thousand dollars to clear the entire river thoroughly of all re- ning obstructions to its free navigation during the nine commer- lly busy months of the year.

This river is in the second collection district of North Carolina.

Money statement.

July 1, 1885, amount available		$1,731 39
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$1,398 67	
July 1, 1886, outstanding liabilities	20 41	
		1,419 08
July 1, 1886, amount available		312 31
mount appropriated by act approved August 5, 1886		15,000 00
mount available for fiscal year ending June 30, 1887		15,312 31
Amount (estimated) required for completion of existing project		35,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888		30,000 00
ubmitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.		

HISTORY OF THE IMPROVEMENT OF CONTENTNEA CREEK, NORTH CAROLINA.

1880-'81. By the river and harbor act of 14th June, 1880, a survey or examination of this stream was ordered. It was made by Mr. Reid Whitford, in January, 1881.

The improvement proposed consisted in the removal of all obstacles in order to secure during the season of flush water 3 feet navigation from its mouth to Stantons-

burg, 70 miles above. The estimated cost of such improvement was $40,0
gress, by act of March 3, 1881, appropriated $10,000 for this work.

1881-'82. On the 14th of September, 1881, work was begun at the mouth
tinued with improvised means, cleaning the stream of logs, stumps, &c.,
tially for about 4 miles up stream. Within 1¼ miles of the mouth 750 fe
dams or dikes were put in experimentally. On the 1st January, 1882, the m
from the Neuse was transferred to this stream, and the work of cleaning t
and its banks progressed up to within 3 miles of Hookerton. An accurat
of obstructions removed was not kept. On the 22d of March, 1882, work was s
for want of funds.

1882 and 1883. The river and harbor act of August 2, 1882, appropriated $1
continuing this work, and it was resumed 1st of November, 1882, and by 1st o
1883, was carried to Snow Hill, about 45 miles above the mouth, clearing o
season before. During April and May little was done on account of high w
June the "Lower Narrows" were greatly improved and a large amount
done. During the season of 1882-'83 785 logs and 969 small logs and 1,02
were taken from the bed of the stream and 568 large and 3,570 small trees
the banks.

1883 and 1884. Only a small amount of the appropriation remained on h
the force was kept at work during July, 1883, near the mouth in the "Narro
over 250 large stumps with an uncounted number of small ones and "cypres
were taken out. Want of funds stopped operations at end of July, 1883.

1884-'85. On August 5, 1884, Congress made a further appropriation of
continue this improvement.

On the 1st of December, 1884, a survey by Assistant Engineer J. P. Dar
begun and continued for ten days near the mouth to determine accurately o
&c. It was discontinued on the 10th of December, 1884, on account of high w
information of valuable import was obtained. On the 9th of February, 1
plant belonging to Neuse River was transferred to this stream, and on 17th
month work was resumed at Snow Hill and proceeded down-stream over w
been done, and between the 19th of February and 27th of April, 1885, 926 logs
stumps were taken from the bed of the stream and 174 large trees cut from th

1885 and 1886. On the 3d of November, 1885, work was resumed on this stre
the mouth and continued to the 10th of December, 1885, when stopped by hig
In this thirty-seven days 420 linear feet of lumber dikes were put in (342
work and 78 feet repairs); 400 feet of brush and log dam, near head of Spring
was built; 230 feet old dikes removed; 57 trees, 20 logs, and 62¼ cords of br
450 feet of bank cleared; 59 logs, 52 snags, 14 stumps, 11¼ cords of small stuf
cubic yards of mud taken out of slough and stream.

R. RANSO
Assistant En

MARCH 25, 1886.

L 2.

IMPROVEMENT OF TRENT RIVER, NORTH CAROLINA.

Trent River, a tributary of the Neuse River, has a total length c
73 miles, and a drainage area of 657 square miles. This river in
the time when placed under governmental improvement, poss
6-foot to 8-foot roughly cleared navigation from its mouth at Nev
up 21 miles to Pollocksville, and a lighter-draught navigation 9 mi
ther to Quaker Bridge. Above Pollocksville the bars, snags, an
prevented all navigation, except occasionally by small flat-boats
high freshets.

Its commerce is estimated to have been about $400,000 of go
year.

The original projects of 1879 to 1880, as continued to date, a
that 6 to 8 feet of water could be carried at all stages from its m
miles to Pollocksville, and proposed for $22,000 to secure a tho
cleared 3-foot navigation, with at least 50 feet channel widt
stages of water from Pollocksville 22 miles up to Trenton, the p
ble limit of steamboat navigation, using the balance of the fund

the channel from its mouth 30 miles upwards to Pollocksville and
r Bridge.

estimate was based on an examination required to be made in
haste and at slight expense. The estimate as regards sunken
ctions in the upper 14 miles of river supposed only 25 stumps
gs per mile, whereas an average of 250 per mile were actually

dequate yearly appropriations, involving the alternate disorgani-
and reorganization of working parties, damage to unfinished
extra superintendence, and deterioration of plant, have added
lerably to the cost of the work. The aggregate amount appro-
d for this project up to 30th June, 1886, is $42,000.

present estimate (that of 1885), $57,000 for the final cost of the
is based upon these later developments.

ty-one thousand four hundred and eighty-nine dollars and six cents
een spent in all upon this improvement up to 30th June, 1886, in
ing a moderately well cleared 6-foot to 8-foot navigation at all stages
9 feet at ordinary stages) from New Berne 30 miles up to Quaker
e; and thence a thoroughly cleared 3-foot navigation at least 50 feet
at all stages 13 miles further to Trenton, and an excellent turning-
at Trenton. In consequence of this improvement, a steamboat nav-
n has been permanently established over the entire river to Trenton,
weekly trips in summer and tri-weekly trips in the busy seasons of
r. The commerce is still increasing, and is now about $600,000 of
transported per year (including rafted goods), showing that each
spent on this improvement has been accompanied by the develop-
of about $5 of annual commerce.

navigation of this river is not obstructed by bridges without draws.

special work of the year is as follows:

penditures, $159.50.

ing to the small amount of available funds no work could be ad-
geously carried on in the field. The office work has been restricted
completion of records, rendition of reports, and preparation for
le future work.

rief history of past work upon this improvement has been pre-
by Assistant Engineer R. Ransom, and is herewith appended.

ommendations for future work are as follows: That the present
ved and adopted project be completed by thoroughly clearing the
t channel of its remaining obstructions, at a total cost of $15,000
ition to the $535.94 available 30th June, 1886; this amount to be
riated in one sum within the next year. Smaller appropriations
crease the cost by about $2,000 per appropriation.

r this is done no further improvement is recommended at present;
e proper maintenance of the improved channel may cost from
to $2,000 per year.

improvement, as regards cost and order of work, should be car-
approximately as follows:

thousand dollars to open a channel 100 feet wide and 8 feet deep
h Foy's Flats by dredging and blasting.

t thousand dollars to cut off projecting points at sharp turns of
er.

e thousand dollars to clear the entire river thoroughly of all re-
g obstructions to its free navigation.

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iver is in the collection district of Pamplico, N. C.

Money statement.

July 1, 1885, amount available..		
April 23, 1886, amount received from sales to Contentnea Creek...........		
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885........................	$158 78	
July 1, 1886, outstanding liabilities........................	72	
July 1, 1886, amount available		
Amount appropriated by act approved August 5, 1886		
Amount available for fiscal year ending June 30, 1887		

{ Amount (estimated) required for completion of existing project........
Amount that can be profitably expended in fiscal year ending June 30, 1888
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

HISTORY OF THE IMPROVEMENT OF TRENT RIVER, NORTH CAROLIN

The Trent River, from its mouth at New Berne, is navigable to Trenton,
3-feet draught boats the year round.

1878. In December, 1878, a survey was made by J. M. Wolbrecht, under t
of Capt. C. B. Phillips, Corps of Engineers, from Trenton to New Bern
map was made by Wolbrecht of that part of the river, and an estimate fo
submitted to accomplish certain improvements having in view the clearing
of snags, logs, stumps, overhanging growth, putting in temporary dikes, an
ing shoals. (See report of Wolbrecht, accompanying Report Chief of Enginee

1879 and 1880. In July, 1879, Congress made an appropriation of $7,000 fo
provement. The work of clearing the channel of logs, &c., and overhanging
was begun in September, 1879, and on February 7, 1880, the first steamer
Trenton. On February 9, 1880, work was suspended for want of funds. T
cipal work was done between Quaker Bridge and Trenton, a distance of
and consisted in moving more than four times the number of obstructio
had been estimated for. The two cut-offs in this distance were widened a
ened, and boats could not pass them without such improvement. No dik
found necessary, and none has been constructed.

1880 and 1881. On June 14, 1880, $10,000 was appropriated by Congress for
tinued improvement of this stream. The work of clearing out was res
August, 1880, at the mouth of the river and carried to Quaker Bridge,
which point was reached in November following, when all work was susp
February, 1881. A dredge-boat was hired in November, 1880, at Baltimore,
ing to bad weather and other causes, did not get to work till February
Dredging was done at several points between Quaker Bridge and Trenton
near Foscue's Landing, at cut-offs, Horse Lot or Ford, and within 1¼ miles
ton. About 25,000 cubic yards of material were moved, some of it shell rock
ing blasting. The dredging cost about 25 cents to the cubic yard.

1881 and 1882. On March 3, 1881, $5,000 additional were appropriated
gress for this work, and much of that amount was expended by June 30, fo
Dredging was continued to August 18, 1881, and about 18,000 cubic yards of
moved, including 2,000 cubic yards shell rock, which had to be blasted. T
nel was completed up to Trenton, and an unfinished turning basin was
Trenton. A small force on the banks was worked until August 31, 1881,
want of funds, all work was suspended.

1882 and 1883. Congress appropriated $10,000 more for this improvement A
1882. The main work to be done was dredging, and it was found impracti
hire a suitable dredge-boat; so nothing was done except by a small force,
provised means, in removing 600 large and about twice the number of small t
the banks, and taking 73 logs from the channel over the whole course of th
below Trenton. This latter work was done in November and December, 1
January, 1883. Nothing was done from January, 1883, to June, 1883.

1883 and 1884. During August, September, October, and November of 1883
force was employed without regular machinery in removing obstructions fro
and channel. Of these 164 were large logs, 114 small ones, and 13 stumps we
from the channel, and two small stone shoals were broken down by blasting

ance above Foscue's Landing. Late in December, 1883, a dredge was put to work continued till end of March, 1884. The basin at Trenton was dredged to ample for any boat that could reach Trenton. About 25,000 cubic yards of material e taken from the channel mainly from Trenton to a point 4 miles below, but one l-rock shoal near Haus plantation was blasted and dredged, and several short ds were dredged off in the near vicinity. From December 1, 1883, to April 1, 1884, of the steam hoisters from the Neuse was used in taking out obstructions. An rate account of this work was not kept. A portion of it was removing 102 large and 67 stumps from channel and cutting off 278 large trees from banks and driv- 44 large piles at Turning Basin, Trenton. The most of the dredged material had e moved by hand and some required blasting.

84 and 1885. July 4, 1884, an additional appropriation of $10,000 was made by gress for the prosecution of this work, and from December, 1884, to April, 1885, Turning Basin, at Trenton, was well and strongly revetted with wood and dug to et deep at low water, and the river from mouth to Trenton was cleared of snags, s, &c., and overhanging growth; 565 logs and 52 stumps were taken from the nel. In February and March, 1885, careful surveys were made by Assistant En- eer J. P. Darling where dredging was supposed to be necessary, particularly near nton and at Foy's Flats, about 5 miles above New Berne. From April 3 to June 20, 5, the river was dredged for 4,300 feet from Turning Basin, at Trenton, 4 feet deep 175 feet wide to secure a 3-foot channel at low water, and 11,825 cubic yards of terial were taken out. A log revetment extends along a great part of this 4,300 t below Trenton.

he total amount appropriated for this work to date is $42,000. The work has been e by hired labor, and partially by hired machinery. The first dredging near nton filled afterwards on account of high water and the looseness of the sand and very steep banks, and the basin, as at first revetted, was found to be so tempo- y as to require the subsequent work.

his work from beginning till 1885 was carried on to facilitate, as much as possible, commerce over the river, and the smallness of the appropriations made it neces- y to conduct it in apparently disconnected and irregular ways.

R. RANSOM,
Assistant Engineer.

ARCH 25, 1886.

L 3.

IMPROVEMENT OF THE NEUSE RIVER, NORTH CAROLINA.

Neuse River, emptying into the Pamplico Sound, has a total length of out 360 miles and a drainage area of 5,781 square miles (2,506 of which situated above the mouth of its upper main tributary, the Content-). This river, when placed under governmental improvement in 8, possessed during nine months of the year a 9-foot depth of chan- from its mouth 40 miles up to New Berne, thence a 4-foot depth 50 es further to Kinston, thence a 3-foot depth 46 miles further to Golds- o', and thence a 2-foot depth 62 miles further to Smithfield, this nnel depth being reduced during the low-water season to 8 feet at w Berne, 2 feet at Kinston, and 1 foot at Smithfield. Over the whole miles the river was so blocked by war and other obstructions that igation was impracticable. Its steamboat navigation was therefore hing.

The original projects of 1871 for below Goldsboro', and of 1879 for ve Goldsboro', contemplated for $174,000 in all, the removal of the r blockades and natural obstructions (only six thousand logs and snags) d the excavation of a few cut-offs, so as to get 4.5 feet at low water the year to Goldsboro', and 3 feet during nine months to Smithfield. wever, over sixteen thousand logs and snags had to be removed; d over 5,000 linear feet of log and brush jetties, and 43,000 linear feet plank jetties, have had to be constructed to give only a portion of the ginally projected improvement. The projects of 1878, 1880, and 1883, continued to date, propose to remove all sunken logs, snags, floating

and other obstructions, and to contract the channel-way by j
as to assure during the entire year an unobstructed 8-foot navig
miles up to New Berne, and a similar 4-foot navigation 50 miles
to Kinston, and during nine months of the year a 3-foot naviga
miles further to Smithfield. The aggregate amount appropri
these projects up to June 30, 1886, is $210,000. The present e
(that of 1885), $370,000, for the final cost of the work, is based c
later developments.

Two hundred and five thousand eight hundred and twenty-f
lars and seventy-two cents have been spent in all upon this impro
up to June 30, 1886, giving a moderately well-cleared chann
the entire length of the river, allowing an 8-foot navigation 4
to New Berne, and a 3 foot navigation 50 miles further to Kin
the year; also, a 3-foot navigation 46 miles further to Goldsboro',
nine months per year, and still 62 miles further to Smithfield six
per year. In consequence of this, two steamboat lines have been
nently established between New Berne and Kinston, and the riv
merce has increased from almost nothing up to over $1,000,000 c
transported per year, showing that each dollar spent on this i
ment has been accompanied by the development of about $5 of
commerce.

The navigation of this river is obstructed at points as shown
following extract from special report dated January 17, 1885:

> Near Kinston this river is crossed by the Atlantic and North Carolina Ra
> a draw-bridge, whose draw-span is placed upon the shallow side of the rive
> of over the main channel-way.
>
> The present improvement will probably be so far finished in 1886 as to pe
> deeper navigation above this bridge at Kinston than will then be able to pass
> this draw-opening.
>
> All the steamer captains whom I have so far heard from state that they
> as yet been delayed from want of water at this draw-opening, and I do no
> reason for a change in the position of the draw before 1886.
>
> I therefore recommend that this draw may be permitted to remain in it
> position for the present, but that it be moved to the channel side of the rive
> as it becomes the chief serious obstruction to a permanently increased dept
> igation between New Berne and Kinston.
>
> Near Goldsboro' this river is crossed by the Wilmington and Weldon Rai
> a single-span bridge without a draw. The bottom of the bridge is abou
> above low water. The channel is said to be partially obstructed by a pier of t
> bridge. Very few steamers have so far reached this bridge, although the rive
> gable for several miles above Goldsboro'.
>
> I therefore recommend that this bridge be permitted for the present to
> its present condition, provided that the owners will clear away the obstruc
> tion of the old pier beneath, and provided, also, that they will furnish a suita
> joint to the smoke-stacks of all steamers using regularly this portion of the
>
> Above Goldsboro' and below Smithfield there are six county bridges witho
> but there has as yet been no navigation demanding draws. When needed t
> will undoubtedly be put in by the county authorities. I therefore recomm
> these bridges be permitted for the present to remain in their present condi
> vided that their owners will insert draws therein whenever needed by the st

The special work of the year is as follows:

Expenditures, $9,557.42.

Owing to its variable features, and the difficulty of properly
ing it beforehand and inspecting it afterwards, the work was al
done by hired labor and the purchase of materials in open marl

Between the 6th of July and the 22d December, the river wa
matically contracted by jetties over a total distance of about
situated from 38 to 40 miles above New Berne, and from 10 to
below Kinston. This work could be done advantageously or

stage of water. Work was much delayed by rain, freshets, and kness. Two steam-hoisters were used on all available occasions.

Forty-one jetties (3,896 linear feet of jettying) were thus built in place; 125 linear feet of old undermined jetties, 65 logs, 102 large snags, and cords of small snags, were removed from the river-bed; and 183 trees d 8 cords of brush were removed from 3,450 linear feet of the river k. Maps were made of 2.5 miles of river preparatory to the location f the jetties; 63 guide-piles were driven, and 63 sign-posts were put at the head and foot of 31 sets of jetties. All the old jetties were ther strengthened by the addition of a sill on their up-stream sides low-water level. A water-gauge was kept during the progress of the rk. In June of 1886 the whole plant was overhauled, repaired, and t in order for the coming season's work.

The completion of a thoroughly cleared 4-foot channel from New Berne Kinston will require further jettying over 1.5 miles of river, and the moval of a great many snags, logs, and trees from the bed of the river. This work will be pushed forward rapidly during the coming high-ter season, and carried as far as the present funds will permit.

All the above work has been well and vigorously carried forward der the immediate supervision of Assistant Engineer R. Ransom.

A brief history of past work upon this improvement has been prepared y Assistant Engineer R. Ransom, and is herewith appended.

Recommendations for future work are as follows: That this improve-nt be completed in accordance with the present approved and adopted jects, so as to secure a thoroughly cleared 9-foot navigation 40 miles to New Berne, and a similar 4-foot navigation 50 miles further to nston during the entire year, and thence a similar 3-foot navigation 8 miles further to Smithfield during nine months of the year, at a tal expense of $160,000 in addition to the $4,174.28 available 30th June, 1886, this amount to be appropriated in three yearly installments f about $60,000 each.

Smaller yearly appropriations, involving the alternate disorganization and reorganization of working parties, damage to unfinished work, extra superintendence, and the deterioration of plant will increase the cost of the work by from $2,000 to $6,000 per appropriation. Further improvements, so as to extend the navigation above Smithfield, or so as to increase the depth of water or length of time of such navigation below Smithfield, is not recommended at present.

After the improvement is finished its proper maintenance may cost from $2,000 to $6,000 per year.

This improvement, as regards cost and order of work, should be carried on approximately, as follows:

Thirty thousand dollars to secure an unobstructed channel of 3 feet depth at low water from New Berne, 50 miles upwards, to Kinston, by completing the present work of contraction of the river channel.

Thirty thousand dollars to secure a thoroughly cleared natural channel from Kinston, 108 miles upward, to Smithfield, by removing all sunken logs and snags, and by cutting down and pulling back from caving banks the trees which would otherwise soon fall into the river.

Twenty thousand dollars to increase the channel depth from New Berne to Kinston to 4 feet at low water by dredging and jettying.

Eighty thousand dollars to increase the channel depth from Kinston to Smithfield to 3 feet during nine months of the year by dredging and jettying.

This river is in collection district of Pamplico, N. C.

Money statement.

July 1, 1885, amount available		$13
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$9,166 05	
July 1, 1886, outstanding liabilities	391 37	
		9,
July 1, 1886, amount available		4,
Amount appropriated by act approved August 5, 1886		22,
Amount available for fiscal year ending June 30, 1887		26,
Amount (estimated) required for completion of existing project		142,
Amount that can be profitably expended in fiscal year ending June 30, 1888		60,

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

HISTORY OF THE IMPROVEMENT OF NEUSE RIVER, NORTH CAROLINA.

Under the direction of Major Craighill, Corps of Engineers, a survey of the was made from New Berne to Goldsboro' in May and June, 1871, by Mr. Wi Popp, and in November, 1878, an examination of the stream from Goldsbor Smithfield was made under direction of Captain Phillips, Corps of Engineers, by J. M. Wolbrecht.

1878 and 1879. By act Congress, June 18, 1878, $40,000 was appropriated fo improvement of the stream. The project adopted contemplated clearing the st of obstructions from mouth to Goldsboro', and making certain cut-offs, but it wa termined to expend the $40,000 in removing obstructions. Preparations were ma September and work began October 1, 1878, at Fort Point 3 miles below New Be taking out artificial obstructions of a blockade placed there during the war betw the States. Only a very narrow channel was then open; one, 550 feet wide, was clea taking from it four, and at Johnson's Point, a mile below, two vessels, a lot of p and two lines of "Yankee catchers." Blasting was required. A channel east of the of New Berne, and close to it, was dredged 450 feet way, 100 feet wide and 8 feet d saving nearly a mile in going from one river to the other, in the year of 1878. At per blockade, 3 miles above New Berne, the channel was widened to 150 feet thro Linkfield Channel by removing five vessels and some piles. The work progresse 15 miles above Kinston by June 30, 1879. The work from Linkfield Channel up confined to removing snags, stumps, and overhanging growth, and in putting in s approaches to the draws of bridges. The clearing out of obstructions was partia it was very desirable to open the way as far up as possible for the passage of bo On the 3d of March, 1879, $45,000 additional was appropriated by Congress to conti the improvement. By the end of June, 1879, five experimental lumber jetties w built just below Kinston.

1879 and 1880. Work of clearing out continued to Goldsborough, which point reached in February, 1880, and the force was taken in March to below New Berne, the whole blockade, where the river is a mile wide, was removed, consisting of 13 sels, several barges, 100 piles, and two lines "Yankee catchers," entirely across stre 5 vessels, 2 barges, and several cribs taken from the blockade 3 miles above New Be A sunken transport was taken out just above Red Old Field. Clearing out snags, progressed to 3 miles above Pitch Kettle by June 30, 1880. The blockade 5 miles low Kinston was partially removed, and an 80-foot channel opened through it. lumber jetties were put in between Kinston and County Bridge below, experim ally to determine proper distance between them for future construction. Ten ro "bank protectors" of double rows of piles filled with brush and logs were built be railroad bridge near Kinston. Two steam hoisting machines were built in sum of 1879.

1880 and 1881. On June 14, 1880, Congress appropriated $45,000, and March 3, 1 $30,000 more to continue this improvement, and allowably by law these amounts c be used to improve the river above Goldsboro'. The work of clearing the be streams and the banks was carried to 12 miles above Goldsboro' from January to 1, 1881. Below Kinston the same work was carried from near Pitch Kettle to Kins Two pile-drivers were put on the hoisters. About 5,000 linear feet of log and br jetties were put in between Pitch Kettle and Deer Neck, and 600 linear feet of brush log dams built near Grindle Creek. The troublesome points at Southwest Bends and Point were revetted with piles and logs for nearly a mile, and at other places on river bank protectors to prevent erosion were built. The brush and log jetties not stand satisfactorily, and in May and June, 1881, 3,230 linear feet of lumber jet were built below and near Kinston.

and 1882. By act of Congress March 3, 1881, $30,000 was appropriated to con-
this improvement, and work of clearing out above Goldsboro' progressed 20
during this season. In June, 1882, 220 large and 231 small logs, 11 large and 25
stumps were taken from bed of stream, and 897 large and 909 small trees cut
anks. This is a fair sample of what had previously been done. On the lowe
the channel east of the city, which was previously dredged in 1878, was ex-
and deepened to 660 feet way, 100 feet wide, and 9 feet deep; 14,550 linear feet
ber jetties were put in between Pitch Kettle and Becton's Old Field. But little
from any cause to lumber jetties this season.

and 1883. Act of Congress August 2, 1882, appropriated $35,000, $5,000 of
was to go to inland line of navigation, New Berne to Beaufort, and $30,000
e River proper. Clearing out continued to Smithfield, which place was reached
, 1883. During the year 2,331 large and 1,891 small logs and trees, and 341
were taken from bed of stream, and 4,988 large and 8,743 small trees cut from
Up to November, 1882, one hoister had been hired; it was then discharged.
thousand eight hundred and twelve linear feet of lumber jetties were built be-
Kinston and Becton's Old Field. During the winter one steam hoister took
, &c., from "Let Alones" above Kinston. Lumber jetties stood well.

and 1884. In July work was gone over from Goldsboro' to Kinston by one
, taking out over that distance 174 large and 31 small logs and 41 stumps. Jetty-
begun August 1, 1883, and continued to October 22, 1883; resumed June 1,
Put in during year ending June 30, 1884, 4,450 linear feet in vicinity of blockade,
below Kinston. During year injury to eight jetties; to two serious. In No-
, 1883, the steam hoisters were repaired.

nd 1885. Act of Congress of July 5, 1884, appropriated $20,000 for continuation
improvement. Between 1st July and middle December, 1884, 121 lumber jet-
regating 12,402 linear feet, over a distance of 5 miles between blockade below
and Becton's Old Field, were built; 164 logs and 50 stumps and several cords
ff were taken from the stream. Maps of 10 miles of river over part jettied
de. Two new quarter-boats and four new flats were built; and a steam
ainly for use in sinking piles by water-jet, was put on one of the hoisters.

nd 1886. Work began July 11, and continued to December 22, 1885. Begin-
out a mile above Becton's Old Field, and continuing to include Deer Neck,
re built 4,509 linear feet of lumber jetties, 1,125 feet of old jetties removed,
and 75 cords of brush cut, 3,450 feet of banks cleared, 102 large snags and 3¼
all stuff taken from bed of stream, 63 guide-piles and 63 guide-posts put up,
river sounded from starting point of season to vicinity of Maple Cypress.

rk on the river has been done by hired labor and some hired machinery. Ma-
ught in open market till 1885; since then by sealed bids.

iginal project contemplated the removal of natural and artificial obstructions
uth to Goldsboro' and making some cut-offs. The idea of cut-offs was after-
andoned. Then it was decided to get a 3-foot channel year round to Kinston,
to Goldsboro' for nine months, and Smithfield for six months in year. Sub-
y it was found expedient to secure a 4-foot channel to Kinston; and work is
ue with that end in view, and to keep open the channel from year to year, as
y may require. Several bridges exist below Goldsboro' all of which have
Including the railroad bridge near Goldsboro' from there to Smithfield, there
n bridges without draws. The draw in railroad bridge near Kinston is on
ide river, and may require change. No demand for draws seems *now* to exist
ey are not.

roper to explain the irregularity apparent in the method of building the jetties.
f object in view at the beginning of the work was to afford all possible facil-
ransportation, and the worst parts of the river received most prompt atten-
hanges from point to point were made as the necessity of the steamers seemed
ed. For the past eighteen months or two years the work has progressed more
y as these passing demands did not occur.

water causes a suspension of operations for the present.

L 4.

VEMENT OF THE LINE OF INLAND NAVIGATION FROM NEW BERNE EAUFORT HARBOR, NORTH CAROLINA, VIA CLUBFOOT, HARLOWE, NEWPORT RIVERS.

inland line of navigation from New Berne to Beaufort Harbor,
ubfoot, Harlowe, and Newport rivers was established in about
nd was used thereafter by small craft until about 1856, when its
roke *down and the route was abandoned.*

This line, about 42 miles in total length, extends from Ne about 23 miles down the Neuse River, 6 miles up Clubfoot Ri miles through the Clubfoot and Harlowe Canal, 3.5 miles down l River, and 6 miles through Newport River to Beaufort Harbor.

Since 1880 the line has been reopened by the New Berne an fort Canal Company so as to allow in 1885 the passage of sma of 15 feet width and 3 feet draught. This inland line of navigat Clubfoot, Harlowe, and Newport rivers was recommended in worthy of improvement, providing that Congress desired to ext already existing lines of navigation from the Chesapeake sout and the cost of a channel 80 feet wide and 9 feet deep, was est at $883,580, increased by the cost of a tide-lock and the can pany's franchise.

Ten thousand dollars were appropriated in 1882 ($5,000 to be from the appropriation for Neuse River, $5,000 from that for B Harbor) for an inland line of navigation from New Berne to B Harbor, and it was decided in 1884 that this money was to be upon the route via Clubfoot, Harlowe, and Newport rivers.

The adopted project of 1884 for the expenditure of this $10, continued to date, proposed to widen and deepen Harlowe Creek secure a through canal of 5 feet depth at mean low water and of bottom width from the mouth of Harlowe Creek upward 3.25 m its head, and to use the remaining funds upon similar works on Cl River. It was required that the work should be done at once a contract. Work was commenced in 1884, but on account of unex obstacles and the small amount of available funds the contractor not afford to build or hire the expensive plant that he would n order to be able to fulfill his contract, and had to abandon the Owing to these developments, and the great disproportion betwe available funds and the estimates of 1883, further work was stop March, 1885, to await the further action of Congress. The agg amounts appropriated for these projects up to June 30, 1886, is $1 The present estimate (that of 1885), $92,000 for the final cost of the is for a channel 30 feet wide and 5 feet deep, adapted to the e navigation of the Neuse River desiring passage by this route to Be Harbor.

Up to June 30, 1886, $2,205.76 has been expended in all upon t provement, on necessary surveys, in superintendence, and in the described commencement of the proposed cutting.

A small light-draught steamer has just commenced running o line, but it has not yet had time to work up a permanent busines

The special work of the year is as follows:

Expenditures, $131.45.

No field work has been done since March, 1885, for the reason given. The canal was inspected in April; and in June, 1886, aut was given to expend about $800 in removing logs and snags fro bed of Harlowe Creek, and this work will be commenced in July

A history of past work upon this improvement has been prepa Assistant Engineer R. Ransom, and is herewith appended.

Recommendations for future work are as follows: That this im ment be extended in general accord with the projects of 1883 an over the whole distance, through the New Berne and Beaufort as well as through Clubfoot River and Harlowe Creek, so far as cure a through channel of 5 feet depth at mean low water and bottom width from the mouth of Harlowe Creek to the mouth o foot River, thus completing a 5-foot navigation from New Be

ort, at a total expense of $85,000, in addition to the $7,794.24
ble June 30, 1886; this amount to be appropriated in two yearly
nents of $50,000 and $35,000, respectively. Smaller yearly ap-
ations, involving the alternate disorganization and reorganization
king parties, damage to unfinished work, extra superintendence,
e deterioration of plant, will increase the cost of the work by
1,500 to $4,000 per appropriation.

o funds are appropriated for the fiscal year ending 30th June,
he $7,794.24 on hand should be used by hired labor and open
se of material to give as good a channel as possible to the craft
ing this route. If well opened this line would be of much value
necting link between Pamplico Sound and Beaufort Harbor, and
complete an otherwise already existing inland navigation from
esapeake to Beaufort, N. C.

dangers of ocean travel around Cape Hatteras and Cape Lookout
great that some such 5-foot navigation for small vessels appears
ry between Pamplico Sound and Beaufort Harbor, and no similar
tion can be secured by any other route, except at greatly increased
e. Further improvement over this route, so as to secure a chan-
more than 5 feet depth at low water is not recommended for the
.

r this improvement is completed its proper maintenance may cost
1,000 to $3,000 per year.

improvement as regards cost and order of work should be carried
roximately as follows:

y-five thousand dollars to secure a channel 30 feet bottom width
eet deep at low water from the head of Harlowe Creek 3.25 miles
ard to a 5-foot depth at low water in Newport River by dredging.

en thousand dollars to secure a similar channel from the head of
ot Creek to the Neuse River by dredging.

y thousand dollars to repay the New Berne and Beaufort Canal
ny its past expenses of dredging in the canal, and to secure a
l of 30 feet bottom width and 5 feet depth through the canal by
ng.

ork is in the collection districts of Beaufort and Pamplico, N. C.

Money statement.

1885, amount available		$7,925 69
886, amount expended during fiscal year, exclusive of ties outstanding July 1, 1885	$1 97	
1886, outstanding liabilities	129 48	
		131 45
1886, amount available		7,794 24
appropriated by act approved August 5, 1886		10,000 00
available for fiscal year ending June 30, 1887		17,794 24
nt (estimated) required for completion of existing project		77,000 00
nt that can be profitably expended in fiscal year ending June 30, 1888		50,000 00
tted in compliance with requirements of section 2 of river and or acts of 1866 and 1867.		

OF THE IMPROVEMENT OF INLAND LINE OF NAVIGATION, NEW BERNE TO BEAUFORT.

sixty years ago the State of North Carolina cut a small canal from the head
oot Creek to the head of Harlowe Creek, thereby connecting Neuse and New-
ers. For thirty years the canal was used for small craft, but for the past
ears has hardly been used at all.

In the winter of [illegible] a survey, in connection with a contemplated line navigation from Norfolk, Va., to Wilmington, N. C., was made over this rou Engineer Department under the direction of late Capt. C. B. Phillips, Cor gineers.

On 2d August, 1882, an allotment of $5,000 each was made from the appro of Neuse River and Beaufort Harbor to improve the water-way between N and Beaufort, but some indefiniteness in the law delayed beginning work u til.

In the fall of 1883, under the direction of Captain Mercur, Corps of Engi P. Darling, assistant engineer, made a survey of Clubfoot and Harlowe cr part of Newport River, and submitted an estimate for the work.

During 1884 it was determined to expend the $10,000 above mentioned, u lowe Creek over the line surveyed by Darling, and a project was adopted w to secure a channel 30 feet wide at bottom and 5 feet deep at mean low wa the course of the creek from head to mouth. The work was let by contract Morgan. The specifications required a clear berm of 12 feet from edge of cut, material dredged should be deposited on one side, and that the material shou [illegible] be over 4 feet high.

In October, 1884, the line was staked, and on the 29th that month the first a simple and small dipper-pattern one, was at the point where the work was t This machine failed, after repeated trials, to comply with requirements of c On [illegible] December, 1884, a grapple-dredge came, but failed likewise to fill t tract. Besides, caving on account of the nature of the marsh occurred, and ments of two kinds were made to floor the marsh, but with results hardly satis

The contractor suspended operations after taking out less than 2,000 cubi and by the 13th of March, 1885, had withdrawn his machinery.

The Engineer Department recommended an annulment of the contract future prejudice to the contractor.

It is now recommended by Capt. W. H. Bixby, in general charge, to extend t our adopted project through the New Berne and Beaufort Canal as well as t Clubfoot and Harlowe creeks, so as to secure a 5-foot depth at mean low wate 30-foot bottom width from mouth of Harlowe Creek to mouth of Clubfoot Cre total expense of $90,000.

All operations are suspended to await the action of Congress upon the abo commendation.

The old canal connecting Clubfoot and Harlowe creeks a few years ago fell i hands of a private corporation, and they have dug it out over nearly the entire to a depth of 3 feet at mean low water and a width at bottom of about 30 feet

During the season of 1884–'85 a resurvey was made by order of Capt. W. H. Corps of Engineers, of Harlowe Creek from its head to its mouth by R. B. Burk veyor, under supervision of R. Ransom, assistant engineer. Bench-marks were lished; high and low water lines and line of soft and hard marsh marked; sou of water taken over the whole course, as well as soundings of mud on each side stream, records of which survey are in the central office at Wilmington, N. C.

R. RANSOM,
Assistant Eng

MARCH 27, 1885.

L 5.

IMPROVEMENT OF BEAUFORT HARBOR, NORTH CAROLINA.

Beaufort Harbor, at the eastern terminus of the Atlantic and Carolina Railroad, is the only harbor of any importance between C peake Bay and Wilmington, N. C., a distance of over 300 miles. especially valuable as the natural outlet to the inland commer northern and middle North Carolina and as a natural harbor of r to vessels overtaken on this most exposed portion of the Atlantic If its channel were marked by range lights it would be the easies bor to enter between the Chesapeake and Savannah. Beaufort H when placed under governmental improvement in 1880 possessed entrance of 13.3 feet least depth at mean low water, with an av

nd fall of tide of 3 feet. At this time, however, the harbor entrance
apidly deteriorating, its width, measured from Fort Macon Point
ackelford Point, having increased 500 feet between the years 1864
1880 and increased 900 feet more between the years 1880 and 1881,
ts bar having rapidly and proportionally shoaled. From the bar,
arbor possessed a channel of 25 feet depth upwards 3.7 miles to
tlantic and North Carolina Railroad Wharf at Morehead City; and
nch channel of 9 feet depth for 0.6 mile up Bulkhead Channel,
f 2 feet minimum depth 0.6 mile further to the wharves of Beaufort
where coasting vessels had a good wharfage of 7 feet depth and
eet length.

original project of 1881 proposed for $82,000 to stop the erosion
ckelford Point by three 200-foot jetties (to cost $30 per linear
and to extend the 9-foot depth of water from Bulkhead Channel
ufort City, by a cutting 200 feet wide, and thence to dredge a 6-foot
l 100 feet wide to North River and Core Sound for the accom-
ion of the small craft of the neighboring sound. The violence of
's action proved so great that the 600 feet of jetty actually cost
36,000 ($60 per linear foot) and is not even yet sufficiently strong.
eover, 400 feet more of jetty became necessary, and similar work
e necessary on the other side of the entrance, at Fort Macon Point.

projects of 1881, 1882, and 1884, as continued to date, proposed
re this harbor by stopping further erosions of the sand-banks at
elford Point and Fort Macon Point, and thus stopping further de-
ation of the bar entrance; and propose to open a 5-foot channel
et wide to Beaufort City. The aggregated amount appropriated
ese projects up to 30th June, 1886, is $75,000. The present esti-
(that of 1885), $159,000 for the final cost of the work, is based upon
xperience of the past years.

wenty-five thousand dollars have been spent in all upon this improve-
t up to June 30, 1886, in successfully stopping the erosion of Shack-
d Point and Fort Macon Point, in probably arresting the shoaling
this bar, and in making a careful survey of the present condition of
harbor entrance preparatory to the definite location of further
s. No improvement of commerce nor depth of water was thereby
cted or obtained, but the retrograde movement has been in gen-
arrested, and the old shore lines have commenced to re-form as de-
. The commerce is now about $1,000,000 exported or imported.

e special work of the year was as follows:

penditures, $2,218.56.

wing to its variable features, and the difficulty of properly specify-
it beforehand and inspecting it afterwards, the work was allowably
by hired labor and the purchase of materials in open market.

ork was stopped on the 8th September to await further appropria-
s; but a few necessary repairs were made later on.

t *Shackelford Point*, the severe storms of August and October, 1885,
hed the stone riprapping away from the top of the main jetty (now
feet long), so as to undermine its coping over one-third of its width
240 feet of its length. The sea-front of the jetty and its coping was
porarily protected in December and January by 220 linear feet of
-work revetment made of logs tied back to the coping by iron rods.
he jetty, however, needs as soon as possible to have this crib-work
laced by heavy stone weighing over 1,000 pounds to the piece.

he middle jetty, built to 100 feet length in 1882, at a point 1,000 feet
st of the main jetty, has almost disappeared by being gradually

washed away by the North River and Core Sound currents. to be reconstructed more permanently.

The east jetty, built to 400 feet length in 1885, at a point east of the main jetty, has been raised by the addition of 165 c of stone (3,246 in all since commencement). It has, as desired, checked further erosion of the north side of Shackelford Poin commenced the restoration of the eroded point. It needs to to above low-water level throughout its length. The bank o side of this jetty has been successfully protected from erosion b brush and stone revetment of 15 feet width and 100 feet lengt

As a result of these jetties, Shackelford Point, during the has, as desired, advanced towards its former shore-lines, from the ocean a strip of beach 200 feet wide and over 1,00 length.

At Fort Macon Point.—The small landing wharf was comple main jetty was extended backwards 115 feet so as to be well c to the sand-hills in its rear. It is now 410 feet long. This was crowned, like the rest of the jetty, with concrete blocks feet long, 6 feet wide, and 3 feet thick, built in place.

The northwest jetty, built opposite the old railroad wharf, t the northern shore of Fort Macon Point from erosion by the River current, was extended 162 feet (202 in all since commen and loaded with 141 cubic yards (200 in all) of stone. It ne raised above low-water level throughout its length. Though u its good effect is already perceptible.

The harbor survey was completed.

All the above work has been vigorously carried forward u immediate supervision of Assistant Engineer R. Ransom.

A brief history of past work upon this improvement has pared by Assistant Engineer R. Ransom and is herewith appe

Recommendations for future work are as follows: That th approved projects be completed, so far as to thoroughly prote elford and Fort Macon from further erosion ($80,000) and to reduced channel of 100 feet width and 5 feet depth, at low wa Bulkhead Channel entirely through to Beaufort City ($4,000), expense of $84,000, in addition to the funds available on the 3 1886; this amount to be appropriated in one sum during the n

Smaller yearly appropriations, involving the alternate disorg and reorganization of working parties, deterioration of unfinis extra superintendence, and deterioration of plant, will increas of the work by from $3,000 to $5,000 per appropriation.

Further improvement in accord with the original project, so cure the Beaufort City a channel of over 5 feet depth at low w Bulkhead Channel, or of any depth of water by any other route River and Core Sound, is not recommended. This improvem thoroughly completed should be permanent. The harbor should be provided with a pair of range lights visible to a dist miles. It would then be of great value as a harbor of refuge. depth of water in its bar could probably be easily increased t at low water, as it is said to have been in 1737 and 1830; would probably cover the entire cost of this increase of depth.

This improvement, as regards cost and order of work, shoul ried on approximately as follows:

Seven thousand dollars to thoroughly riprap with heavy sto pound pieces) the sea front of the main jetty at Shackelford P

it thousand dollars to raise to high-tide level the railroad wharf
t Fort Macon Point.
r thousand dollars to secure a channel 100 feet wide and 5 feet
t low water from Bulkhead Channel through to Beaufort City by
ng.
thousand dollars to re-establish line of sand-dunes along the new
line by means of catch sand fences at Fort Macon Point and Shack-
Point.
en thousand dollars to raise to high-tide level the eastern jetty at
elford Point.
ht thousand dollars to reconstruct with heavy stone the middle
t Shackelford Point.
ht thousand dollars to crown with concrete capping the southern
at Fort Macon.
ty thousand dollars to construct 900 linear feet more of jetties at
elford Point at points south of the main jetty.

fort is a port of entry.

Money statement.

1885, amount available	$2,218 56
1886, amount expended during fiscal year, exclusive of liabilities nding July 1, 1885	2,218 56
appropriated by act approved August 5, 1886	15,000 00
nt (estimated) required for completion of existing project	74,000 00
nt that can be profitably expended in fiscal year ending June 30, 1888	74,000 00

itted in compliance with requirements of section 2 of river and
bor acts of 1866 and 1867.

TORY OF THE IMPROVEMENT OF BEAUFORT HARBOR, NORTH CAROLINA.

vey of the harbor was made by the Engineer Department in 1821, another by
y in 1839, and others by the Coast Survey in 1857, 1862, 1864, and 1876, and by
Phillips, Corps of Engineers, in 1880.
thirty years ago or more five spur jetties of large stone were built on the east
th of Fort Macon at that point. One has entirely disappeared, another much
, and those to the eastward have been added to since 1881.
nd 1882. The river and harbor act, March 3, 1881, appropriated $30,000 for
provement.
roject adopted contemplated placing spur-jetties around Shackelford Point
dging channels to improve approaches to town of Beaufort, but was so modi-
to use the whole appropriation in jettying. Work was begun 1st of April,
wo scows built, wharf put up, tramway started, and the head of a jetty built,
feet of the foundation laid at Shackelford Point. The line of jetty is from
irectly towards the flag-staff at Fort Macon. The foundation of all the jetties
built are of log-mats, firmly fastened, from 30 to 40 feet long, lying cross the
jetty. Nothing was done in 1881, 1882, 1883. The river and harbor act August
, appropriated other $30,000 for this work, but $5,000 of it was to improve in-
ise navigation, New Berne to Beaufort. Five hundred and thirty-five linear
jetty, in line indicated for 1881–1882, 30 feet wide at bottom and raised to mean
ater level, was built. Sand accumulated to top of work for 300 feet of its length.
housand feet east of above-named jetty, up Core Sound, a small jetty 100 feet
15 feet wide at base, 5 feet at top, and 1 foot above mean high water, was built.
housand feet tramway (400 of it trestle), a wharf repaired, 2,800 feet of brush
catch, from 4 to 5 feet high, were also built, and two other scows constructed.
ember, 1882, work was begun at Fort Macon under an appropriation for de-
. The three old jetties, Nos. 1, 2, and 3, beginning from the east, were length-
, broadened, and raised. At that time No. 1 was 145 feet long, No. 2 185 feet
, and No. 3 190 feet long. The sea had cut behind Nos. 1 and 2, and water 4 feet

at low tide ran between the ends and the land. Nos. 1 and 2 were connec
land by laying mats 35 feet wide and raising the whole jetty to 1 foot
high water, with top 6 feet wide. No. 3 was raised and widened as the
except that it was raised to 2.5 feet above mean high water, and its o
broadened by an apron to 30 feet wide. No. 1 was then 295; No. 2, 360;
225 feet long respectively. A tramway 2,020 feet long and a wharf wer
spur at right angles to No. 1, about its middle, was run 150 feet perpendicu
north, 15 feet at base and 4 or 5 on top, was put in to above mean low-
and 5,962 feet of sand-catch fences were built.

1883 and 1884. At Shackelford Point the main jetty, 535 feet long, was ra
above low water, and later 250 cubic yards placed upon it. It was determi
this structure with concrete in blocks 20 feet by 6 feet by 3 feet, 2 inches ap
wise, and material was received to begin the work.

At Fort Macon Point, under a defense appropriation, a jetty 150 feet lo
feet at base was built 350 feet inside of Jetty No. 1 and raised 1 foot above
water. A second one was started about same distance still farther inside, b
for want of funds. The spur to No. 1 was raised 1 foot.

From October 1883, to April, 1884, operations were suspended. Storms i
ber, 1883, and January, 1884, destroyed sand-fences and made a break beh
No. 1, which was stopped with lumber dams. Operations were resumed
1884. Sand-fences were partly restored, 150 cubic yards of rubble-stone added
Nos. 1 and 2, and 300 cubic yards leveling up 540 linear feet of these jetties
concrete capping. About 280 feet, linear, were so placed on Jetty No. 1 in
by 6 by 3 feet, except at out end, where they were 5 blocks of 3 by 6 by 3 fe

1884 and 1885. By act of Congress July 5, 1884, $20,000 were appropriat
tinue this work.

At Shackleford Point 444 linear feet of main jetty was capped with co
blocks 20 by 6 by 3 feet, the jetty being first brought to a level above
water. The outer end was undermined to a slight extent, and stone, toget
about 100 sacks of cement, were added.

Two thousand three hundred feet east of this main jetty a new one 400
in irregular line, 30 feet broad for 200 feet and 40 feet broad for the outer 200
built, not to surface of water. Seven hundred and twenty-one feet of b
stone revetment were laid between the two jetties. The small jetty built in
about disappeared.

A revised project for Fort Macon Point included works then in the harbor
ments. Four hundred and twenty feet, linear, of cuts through sand-hills we
by a crib-work filled with sand 9 feet high by 12 feet wide, most strongly b
of the fort. This crib-work is now half covered by sand-dunes, and the
in front has risen above the level of the highest storm-tides. A small w
started, and a new jetty northwest of the fort and about 125 feet from th
road, was begun and 40 feet of its foundation laid, and under Captain Bixb
H. F. Price, assistant engineer, commenced a survey of the harbor in June,

1885 and 1886. The west end of Jetty No. 1, at Fort Macon Point, was ext
feet and capped with concrete, as the other part, in July and August, 1
small wharf was completed in July, 1885, and about 200 feet of the foun
new jetty west of wharf was put down in July, August, and September, 18

At Shackelford Point 157 cubic yards of stone were put on new jetty in Co
and it is now, for over 175 feet, about on level with low water next the shor
about 9 feet under water at extreme out end. One hundred feet, linear,
stone revetment, 15 feet wide, were laid between the jetties and near the ne

Eleven of the concrete blocks on the main jetty at this point had to be
by strong frame-works of logs and iron rods next the outer end, the third
the end being entirely undermined and fallen its entire length. The act
undermining seems not to have stopped, though no other blocks have fallen

All the foregoing work was done by hired labor.

R. RAN
Assistant E

MARCH 26, 1886.

COMMERCIAL STATISTICS OF BEAUFORT, NORTH CAROLINA.

[Vessels, coasting, 140.]

EXPORTS.

Articles.	Quantity.	Value.
barrels..	2,000	$2,000 00
bushels..	2,000	800 00
do....	40,000	10,000 00
packages..	2,600	10,400 00
pounds..	500	12 50
do....	6,000	150 00
tons..	1,200	300 00
gallons..	20,000	4,400 00
bales..	1,500	67,500 00
bushels..	15,000	19,500 00
atoes..barrels..	1,200	2,400 00
tatoes..bushels..	200,000	100,000 00
rres..barrels..	1,000	800 00
ions..number..	100,000	8,000 00
merchandise..tons..	15,136	45,408 00
tal	....	271,670 50

IMPORTS.

Articles.	Quantity.	V
merchandise, guano, ice, coal, corn, &c	....	$750,000 00
tal value exports and imports	....	1,021,670 50

REMARKS.

number of foreign vessels either entering or departing and of home vessels ed is not stated.

L 6.

IMPROVEMENT OF NEW RIVER, NORTH CAROLINA.

w River, emptying directly into the Atlantic Ocean between Beau- Harbor and Wilmington, N. C., has a total length of about 52 miles, drainage area of 492 square miles. Its lower 14 miles, from its h to Jacksonville, forms a fine basin of brackish water of from 500 000 feet width and of at least 5 feet channel depth, with 40,000 of oyster farms, and with rich agricultural surroundings. When d under Government improvement in 1882 it had very poor facili- or transporting its goods to market. Its communication with the was blocked by an oyster-rock barricade, through which there ed only a long and very crooked channel of 50 feet width and 3 feet at low water. Its commerce, limited to wagons and small boats, estimated to be about $400,000 of goods per year.

e original project of 1882 proposed for $40,000 to secure a 150-foot nel 5 feet deep at low water from the upper river to the ocean, by ging the old channel to its full size through about 7,000 feet of this r-rock barricade. Ten thousand dollars was appropriated, but no y was spent upon this improvement up to 30th June, 1885, because available funds were regarded as too small to allow of their being t profitably.

e location and the surroundings of the proposed work were per- lly inspected in June 1885. This inspection revealed the fact that the improvement was much needed, and that a differently locate nel might be better for permanent improvement, and that the a' funds might be sufficient to cut this channel wide and deep eno immediate use.

The aggregate amount appropriated for this project up to 30t 1886, is $10,000. The present estimate (that of 1885), $40,000, final cost of the work, is the same as that of 1882, except th based upon a new location of the channel.

Nine thousand eight hundred and ten dollars and twenty-fou has been spent in all upon this improvement up to the 30th Jun replacing the long and crooked channel by a short and straigh nel of 40 feet bottom width and 3.5 feet depth at low water. Th channel gives great satisfaction to the neighborhood, is already i use by the craft entering New River from the ocean, and is st deepening under the scour of the river and tidal currents. Tl provement is too recent to show as yet any marked increase in th merce of the river.

The river navigation is not obstructed by any bridges below it ent head at Jacksonville.

The special work of the year was as follows:

Expenditures, $9,810.24.

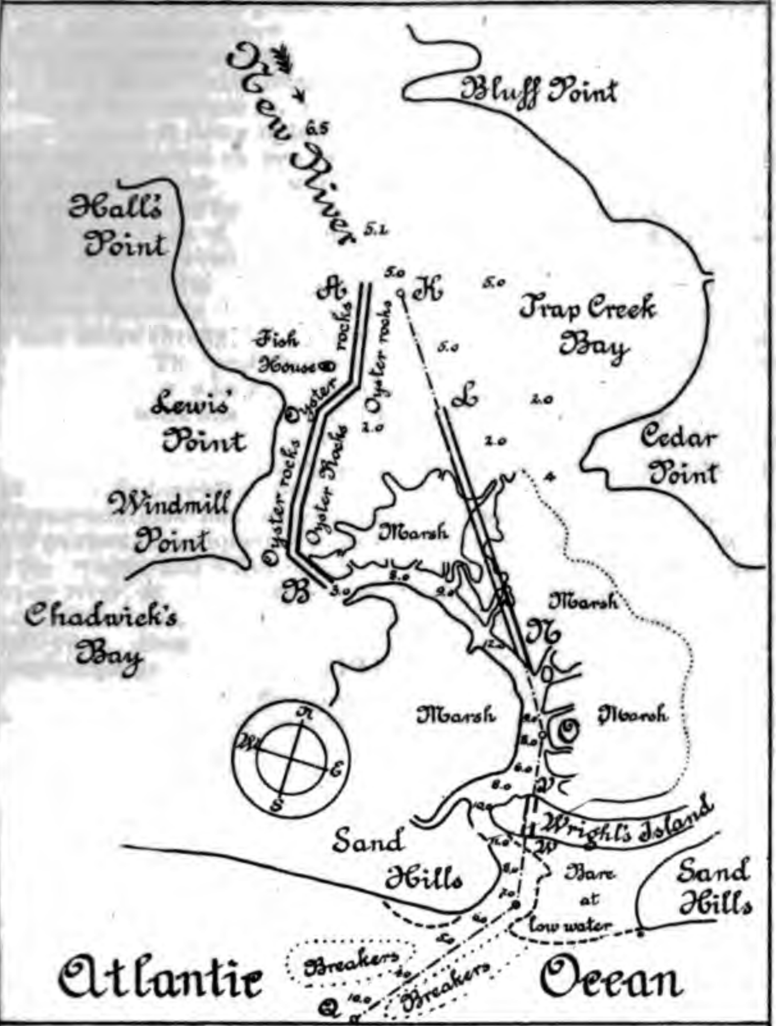
The amount of funds available for this improvement was so sma difficulty of getting to the place of work so great, and the nature work so troublesome, that no available bid could be expected fr sponsible contractors in case the work was advertised and bid licited in due form. Work was, therefore, allowably done by labor and the purchase of materials in open market.

All work in the field was postponed until cold weather rendere locality safe as regards health. In July a brief survey was made a new project suggested. In November and December, 1885, survey was made, the line of cutting staked out, the right of wa tained, and the new project approved.

In January an agreement was entered into with Mr. Rittenl Moore, of Mobile, for the removal of about 32,000 cubic yards o material along a line through the marsh at Cedar Bush Cove, f cents per cubic yard, measured *in situ*, this material to be depo over 30 feet away from the cutting and to be removed in such way give a final through cut of about 40 feet bottom width and about depth at low water. This special agreement was made because it known that Mr. Moore had at leisure a dredge just exactly suit the work and a foreman who was familiar with the locality and could be depended on to do thoroughly the desired work. Bet the 1st of March and the 27th of May this dredge removed 32,284 yards of sand, shells, and mud, opening a straight channel 5,80 long, 40 feet wide at bottom, 4 feet deep over the greater portion length, and 3.1 feet deep at its lower end. This least depth, a pected, is steadily increasing under the scour of the river and currents, and had reached 3.5 feet on the 30th June, 1886. The ebl flood currents through this cut have now a maximum of from 2 t miles per hour, according to circumstances.

Stormy weather and low tides caused the dredge to lose twenty in getting to its place of work and four days in returning from The fluidity of the dredged material required constant piling alon embankment of deposited material. A broken boom caused a si delay of six days. After the cut was opened the dredge was impris seven days in the cut by banks of sand that formed under its sc

New River, N. C.



Scale of yards

200 0 200 400 600 800 1000 1200 1400 1600 1800 2000

A B = Channel proposed in 1882
NOPQ = --- --- --- 1885.
LN = --- out 4.0 feet deep in 1886.
VW = --- --- to low water in 1866.

Surveyed by Asst. Engr. Reid Whitford, and reduced in the office of Capt. W. H. Bixby, U. S. Engrs, to accompany his annual report of 1886. W.H.Bixby

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THE AMERICAN GRAPHIC CO.,N.Y.

wn stream end during ebb tide. In view of these misfortunes, and d the consequent of no profits to the dredge owner, the carefulness, oroughness, and absence of complaint with which he continued to do e agreed work, reflects great credit upon Mr. Moore, and his foreman r. Lord, and deserves special mention.

In May and June a second cut was opened across Wright's Island, out 1 mile below Cedar Bush Cove Marsh. The available funds were t sufficient to complete this cut to a serviceable depth; but it was very sirable to open it down to low-water level so that the river and ocean rrents might have a chance to scour it out to a useful depth while ther appropriations were waited for.

The work was done by hired hand labor. Between the 31st of May d the 28th of June 2,707 cubic yards of marsh turf and mud were en out, opening a cut 1,200 feet long, 30 feet wide, and from .1 to .5 t deep at low water. The ends of this cut were opened out to a width 75 feet to facilitate the entrance of the currents. At mid tides the ter now flows through this cut with a velocity varying from 2 to 3.5 les per hour. The probabilities of the desired scour are very great.

A water-gauge was kept during the progress of the work.

All the above work has been carried on with great vigor and thoroughness under the immediate supervision of Assistant Engineer Reid Whit-rd. His full report, including a brief history of past work upon this provement, is herewith appended.

Recommendations for future work are as follows: That the present pted project be completed so as to secure a channel of from 100 to 150 feet width, and 5 feet depth, at low water, from the ocean up to e upper river, at a total expense of $30,000 in addition to the $189.76 ailable 30th June, 1886, to be appropriated in a single amount within e next year. Smaller yearly appropriations, involving the alternate organization and reorganization of working parties, damage to unfinished work, extra superintendence, and deterioration of plant, will increase the cost of the work by about $2,000 per appropriation. Further nprovement, so as to give a channel of greater depth or width, is not ecommended at present. This improvement, once thoroughly completed, should be permanent.

This improvement, as regards cost and order of work, should be carried n as follows:

Three thousand dollars to secure a channel 30 feet wide and 4 feet leep through Wright's Island by dredging.

Two thousand dollars to extend the existing channel above the upper arsh upward through a few obstructing oyster beds by dredging.

Twenty-five thousand dollars to increase the dimensions of the above obtained channel to 100 or 150 feet width and 5 feet depth at low-tide by iredging.

This river is in the collection district of Beaufort, N. C.

Money statement.

July 1, 1885, amount available		$10,000 00
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$9,152 04	
July 1, 1886, outstanding liabilities	658 20	
		9,810 24
July 1, 1886, amount available		189 76
Amount appropriated by act approved August 5, 1886		10,000 00
Amount available for fiscal year ending June 30, 1887		10,189 76

Amount (estimated) required for completion of existing project........
Amount that can be profitably expended in fiscal year ending June 30, 1888
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFF
Georgetown, S. C., July

CAPTAIN: I have the honor to make the following report upon the impro New River, North Carolina, for fiscal year ending 30th June, 1886:

GENERAL FEATURES.

This river is not long and has its beginning and ending in Onslow Coun Carolina. The depth of water at its mouth seemed to have been less th portion of the navigable length of it.

The stream flows through quite a fertile country, and much very fine timbe in its vicinity.

It is especially noted for the extent of oyster grounds at and near its m also for the oysters of superior size and quality which abound there.

The improvement of New River will be especially beneficial to the peopl country, inasmuch as they are isolated from railroad facilities, and they look to the river to furnish means of transportation for the products of their land

The chief impediment to navigation has been the low marsh lands and oys choking up the mouth of the river immediately at the ocean inlet.

Through the "oyster rocks" a narrow, shallow, crooked channel has existe the boats trading in the river have used with difficulty and uncertainty.

HISTORY OF THE IMPROVEMENT.

1855.[*] An act of the North Carolina legislature was passed incorporating a tering a stock company for the improvement of the channel of the river throu rocks" at the mouth.

It was intended to follow generally the natural courses of the channel, an to have been improved by widening and deepening it.

The State appropriated $10,000 for the work, and $20,000 additional was sub by private individuals.

Joseph Etheridge was elected president (he was afterwards succeeded by Humphrey) and E. W. Ward secretary and treasurer.

The plant for the work consisted of a dipper-dredge and necessary scows, Jacksonville, N. C.

The work was under the immediate supervision of a Mr. Abert, civil engine

A considerable quantity of material was excavated and some improvement plished, but the money being expended and the war coming on, the comp disorganized and the scheme was abandoned.

It was expected by the company to derive dividends from their investment lecting toll from passing craft, the amount charged to be governed by their t

1881. Act of Congress of March 3, 1881, provided for a survey of the river. the death of Capt. Charles B. Phillips, Corps of Engineers, United States Arm 14, 1881, Capt. James Mercur, Corps of Engineers, United States Army, assum trol of the work.

1882. The survey was made under the direction of Capt. James Mercur in of this year.

He estimated the improvement to cost $40,000, and his project contemplated ing, straightening, and deepening the old channel route known as "The Roc

An act of Congress of August 2, this year, appropriated $5,000 for the w Capt. Mercur did not think it advisable to begin on so small an amount.[‡]

1884. Captain Mercur was succeeded by Capt. F. A. Hinman, Corps of En United States Army, in March of this year.

An act of Congress of July 5 appropriated $5,000 for the work, making in a able $10,000.[§]

Captain Hinman was succeeded by Capt. William H. Bixby, Corps of E United States Army, in August.

1885. Captain Bixby recommended[‖] that the proposed project be carried o some modifications as to location of the line of work.

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[*] This information was furnished by Dr. E. W. Ward, of Onslow Count Carolina.

[†] See Annual Report of Chief of Engineers for 1882, page 1117.

[‡] See Annual Report of Chief of Engineers for 1883, page 865.

[§] See Annual Report of Chief of Engineers for 1884, page 1046.

[‖] See Annual Report of Chief of Engineers for 1885, page 1082.

n July this year an examination of the ground was made, with this change in w, by Reid Whitford, assistant engineer, under Captain Bixby's direction. He re- rted that a line could be located as desired, and recommended a survey to be made eparatory to staking off the work. In November the same year the survey was ade by the said assistant engineer and the line of the proposed dredging staked f. This new line ran through the marsh land straight from a point near the inlet nd seemed to be better adapted to the successful accomplishment of the desired pro- ct than the old proposed route. The direction of the line, &c., was plainly shown a map forwarded with the report on the survey.

1886. A contract was entered into with Rittenhouse Moore, of the Mobile Dredging mpany, and the work of excavating the cut 45 feet wide and 4 feet deep at mean w water was begun at the upper end of the line on March 1, 1886.

As the work progressed the dredge was delayed by quicksand, shells, and caving aks.

Short sheet piles driven along the cut had to be resorted to by the contractor to hold ck the excavation.

The material for the most part was thrown on one side of the cut, but it occasion- y became necessary to throw some of it on the other side to prevent the banks ring.

The dredge completed the cut on May 17, having removed a total of 32,284 cubic rds of material. It was sent back through the cut to remove some caves, but could t do it, because the velocity of the current caused an eddy behind her, which de- sited so much sand as to prevent progress in either direction.

After some difficulty the dredge was extracted from the cut, and left New River on 27th of May, 1886.

The accompanying letter of Inspector Martin explains in detail the present condi- n of the cut.

After the dredge left, a cut 30 feet wide was made across Wright's Island by hand. n this there were removed 2,707 cubic yards. This work was suspended on the h of June last, owing to the exhaustion of funds. The accompanying letter and file of Inspector Martin's* fully describes the present condition of Wright's Island- and what is left to be done there.

RECOMMENDATION FOR NEXT YEAR'S WORK.

t is respectfully recommended that the cut be deepened to the desired depth, and kened if it is deemed necessary—at least all caves be removed.

COMMERCE.

he commerce during the past year has probably been as large as usual, and has n carried on by sailing vessels.

he work thus far seems to have been an entire success, and will greatly aid navi- ion on the river.

luch praise is due Inspector Martin for the faithful and correct manner with which has performed his duties, and Mr. John A. Dill, overseer of the work through ight's Island, managed his hands so well that he got a large amount of work done short time. Much praise is also due him.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

apt. W. H. BIXBY,
Corps of Engineers, U. S. A.

L 7.

PROVEMENT OF THE CAPE FEAR RIVER ABOVE WILMINGTON (FROM WILMINGTON TO FAYETTEVILLE), NORTH CAROLINA.

The Cape Fear River, above Wilmington, has a total length of about 0 miles, and a drainage area of 7,167 square miles, of which 5,620 uare miles lie above the mouth of the Black River, its main tributary. t Fayetteville, 112 miles above Wilmington, and the present head of vigation, the river varies from 112 feet breadth, 16 inches average depth, 150 square feet cross-section, 1 mile per hour current, cubic feet discharge per second in extreme droughts, up to 1 breadth, 50 feet maximum depth, 7 miles per hour velocity, and cubic feet discharge per second in high freshets. Extreme lo usually lasts from two to four months per year, and 15-foot s water are usually reached once a month during the rest of tl This river when placed under governmental improvement in 18 navigable during the nine flush-water months of the year from W ton, 112 miles, upward to Fayetteville; but the channel for the n miles was badly obstructed by sunken logs, snags, overhangin and shoals; and for the upper 66 miles, it was full of shoals o there was not more than 12 to 14 inches of water during the lo season. At that time the navigation was owned by private parti commerce is estimated to have then been about $800,000 of good ported per year.

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* Omitted.

The original project of 1881–'82, as continued to date, proposed out the private owners of the river for $10,000; then to clear natural obstructions for $43,125 (including superintendence); further provide a continuous channel over its upper 66 miles by of dredging, and by artificially contracting its water-way by through at least thirty-two shoals at an unstated cost (estimated same person in 1872 at $522,720) making practically a total of $ for the final cost of this improvement. The aggregate amount priated for this project up to 30th June, 1886, is $65,000. Duri last year the progress of the work has been examined, compare the original estimates, and new estimates made. It was found th natural obstructions were very numerous and difficult of remova the cost of their removal will exceed the original estimates. In tl four years 8,419 snags, 2,605 stumps, 2,327 logs, 2,205 trees hav removed from the river-bed, and 8,687 overhanging trees cut fr banks; but as many more remain to be moved. The violence freshets has proved too much for brush, log, or ordinary plank j and in my opinion low stone jetties will prove the most economical end. The new estimates for the total cost of the work, $480,200, follows:

For clearing away obstructions:	
18,000 snags, at $1	$
5,000 logs, at $2	
2,500 stumps, at $3	
3,000 cubic yards of rock, at $3	
84,000 linear feet of rock jetties, at $3.50	2
Contingencies (10 per cent.)	
Superintendence (10 per cent.)	
Total required	4
Already spent upon this work	
Total	4

There appears every probability that this expenditure will finall 3 feet actual channel depth (30 inches free draught) over the whole up to Fayetteville for eleven or twelve months per year, and that the merce will be increased by that time to $4,000,000 of goods per ye

Sixty-four thousand five hundred thirty dollars and eighty-one has been spent in all upon this improvement up to June 30, 1886 ing a moderately well-cleared channel over the whole length of ri moderately good continuous 4-foot channel during the entire year

ington 44 miles to Kelly's Cove, thence a similar 2-foot channel
les further to Elizabethtown (a place of considerable commerce),
ence a similar 1-foot channel 42 miles further to Fayetteville; in-
d to 5-foot draught from Wilmington to Fayetteville during seven
s of the year. In consequence three permanently-established
boat lines have been running over the entire distance with full
ht for seven months each year, and with lessened draught the rest
time. The commerce during those years has increased about
00 per year, has been further benefited by exemption from tolls,
now over $2,000,000 of transported goods per year, showing that
lollar spent on this improvement has been accompanied by the de-
nent of about $28 of annual commerce.

navigation of this stream is not obstructed by bridges between
ngton and Fayetteville.

special work of the past fiscal year was as follows:

enditures, $5,516.98.

ng to its variable features and the difficulty of properly specify-
beforehand and inspecting it afterwards, the work was allowably
y hired labor and the purchase of materials in open market.

veen the first July and the last of November, 1886, 41 stumps,
s, 17 trees, 89 large snags, 630 small snags, and 680 cubic yards of
mud have been removed from the upper 54 miles of river bed; 1
eet-pile jetty 40 feet long was built at McCarter's Cross, and an-
150 feet long, at Old Ferry; 1,438 cubic yards of rock and hard-
ve been quarried, transported from 0 to 11 miles, and built into
at Fayetteville, McCarter's Cross, Old Jetties, and Old Ferry;
rs have been placed near low-water mark on the up-stream side
old jetties at Fayetteville; maps of 22 shoals (15.6 miles of river
ave been completed and 27,975 linear feet of jetties have been
l thereon (including 2,553 feet already built). Twenty-two more
oublesome shoals remain to be surveyed.

dead low-water level was established and permanently marked
ous points along the river bank from Fayetteville 60.5 miles down-
to tide-water at Whitehall, and a profile of this water-surface
ade, showing an almost uniform slope of 4 inches per mile. The
vas gauged at dead low water at several points from Fayetteville
s down-stream to Elizabethtown, showing at Fayetteville as lit-
150-square feet of cross-section and 200 cubic feet discharge per
, and at Elizabethtown an increase of only about 50 per cent.

ater-gauge was kept during the progress of the work.

Government steam-launch has done all the towing and other serv-
the working parties upon the river, and, in my opinion, has well
all she has cost during the year, including her repairs. She is
ly boat that can run on this river during dead low water. For
ny and effectiveness during the next season's work she should be
ed with a new and larger boiler and twice as powerful machinery.

k has been much delayed by very low water (as low as 12 inches)
high freshets (as high as 42 feet).

field work was stopped in November for want of funds.

effect of the 2,553 linear feet of jetties so far constructed has been
er the channel and the river at and near Fayetteville and at the
worst places, and to add one month to the duration of low-water
tion, now averaging 9.5 months per year.

he above work has been carried on with great vigor and thorough-
nder the immediate supervision of Assistant Engineer Charles
hreys, whose full report is appended.

Recommendations for future work are as follows:

Were the commerce of the river sufficiently large to justify the ex [illegible] of such an amount, in my opinion the proper method of imp [illegible] would be by the construction of suitable dams and lock [illegible] giving a 6-foot navigation at all times of the year t [illegible] at a total cost of, approximately, $1,200,000. A commerc [illegible] such an expenditure cannot be expected from this l [illegible] for many years. In consequence, the lock-and-dam navigation m [illegible] for the present and a contracted river channel accep [illegible] under the circumstances. It is recommended, therefor [illegible] improvement be completed in accordance with the prese [illegible] and adopted project so as to secure a thoroughly-cleared channel from Wilmington 70 miles to Elizabethtown; thence a s [illegible] channel 42 miles further to Fayetteville during 11 or 12 n [illegible] year, at a total expense of $415,000, in addition to the $ [illegible] 30th June, 1886; this amount to be appropriated in installments of about $60,000 yearly. Smaller yearly appropri [illegible] the alternate disorganization and reorganization of w [illegible] damage to unfinished work, deterioration of plant, and [illegible] will increase the cost of the work from $1, [illegible] per appropriation.

[illegible] improvement so as to extend the navigation above F [illegible] so as to increase its depth below Fayetteville, is not [illegible]

[illegible] improvement is completed its proper maintenance m [illegible] to $3,000 per year.

[illegible] improvement as regards cost and order of work should l [illegible] approximately as follows:

[illegible] of each appropriation to increase the draught at the sl [illegible] troublesome points of the river by contracting the rive [illegible] jetties at these points, such jetties to be so located in acco [illegible] predetermined systematic project for the entire river.

[illegible] of each appropriation to remove the most troubleso [illegible] in the river channel and to cut down and pull back th [illegible] leaning trees on the river banks.

[illegible] in the collection district of Wilmington, N. C.

Money statement.

[illegible] amount available		$
[illegible] amount expended during fiscal year, exclusive of [illegible] outstanding July 1, 1885	$5,480 74	
[illegible] outstanding liablities	36 74	
[illegible] amount available		
[illegible] appropriated by act approved August 5, 1886		1
[illegible] for fiscal year ending June 30, 1887		1
[illegible] required for completion of proposed project		40
[illegible] profitably expended in fiscal year ending June 30, 1888		6

[illegible] compliance with requirements of section 2 of river and [illegible] 1886 and 1887.

t of proposals for furnishing a steam-boiler, opened June 30, 1886, by Capt. W. H. Bixby, Corps of Engineers.

Names and address.	Description.	Amount.
msey & Son, Baltimore, Md.	For a boiler to evaporate 100 gallons of water per hour into dry steam.	*$600 00
	For a boiler to evaporate 240 gallons of water per hour into dry steam.	*1,250 00
	For a boiler to evaporate 400 gallons of water per hour into dry steam.	*2,400 00

* Delivered.

ted. Prices too high.

REPORT OF CHARLES HUMPHREYS, ASSISTANT ENGINEER.

WILMINGTON, N. C., *April* 1, 1886.

TAIN: I have the honor to make the following report on the improvement of
pe Fear River, North Carolina, from Wilmington to Fayetteville, for the fiscal
ding June 30, 1886:

ations in the field closed in November, when the plant was removed to Wil-
n and turned over to the Lower Cape Fear watchman. The work has been
d to the removal of stumps, logs, snags, &c., from the bed of the river and
nging trees from the banks; to the construction and repair of jetties; and to
ing, leveling, and mapping the river; and preparing projects for future work;
g for discharge, and keeping a daily record of the water-surface.

oved 41 stumps, 97 logs, 17 trees, 89 large snags, 630 small snags, 680 cubic yards
l mud; stripped, quarried, and hauled to river-bank 1,438 cubic yards of rock
rdpan; loaded on scows and towed to jetties [from 2 to 11 miles] and sunk
bic yards; removed at Old Jetties, from east side of river, and put on jetties
t side at that point, 277 cubic yards rock; reloaded at Fayetteville, on scows,
rapped jetties there with 172 cubic yards rock; made bolts and put stringers
et-pile jetties Nos. 13, 12, 10, 8, 7, 6, 5, 4, and 3, at Fayetteville, the top of the
rs being about 2 inches or less above dead low water. [The present height of
etties is about 4.3 feet above dead low water.]

of Windom, Callahan's, and Melvine's were made and forwarded to you, also
howing the effect of the jetties at Fayetteville, McCarter's Cross, Old Jetties,
d Ferry.

river was gauged between Fayetteville and Elizabethtown when it was at or
s lowest stage; drawings have been handed you showing these gaugings. The
w-water line was permanently marked along the river-bank. A profile of the
ter surface has also been made, approximate levels being run from Fayette-
Whitehall, 60½ miles below, where the tide swells slightly at dead low water.

maps made and forwarded to you cover a length of 15.66 miles of river, and
the following shoals: Fayetteville, McCarter's Cross (1 mile below), Old Jet-
miles below), Howard's (3 miles below), McRae's (5 miles below), Evans's (6
elow), Rockfish (7 miles below), Smith's Cross No. 3 (8 miles below), Old Ferry
s below), Thames (12½ miles below), Smith's Cross No. 2 (13½ miles below), The
(20 miles below), Prospect Hall (21½ miles below), Windom (23 miles below),
an's (28 miles below), Kane's Gap (29 miles below), Purdy's (30 miles below),
e's Cross (31 miles below), Morehead (36½ miles below), McDowell's (38 miles
), Elizabethtown (42 miles below), and Elizabeth (42½ miles below).

wings have been made showing your "directions for future work" at all of
shoals, giving a total of 27,975 linear feet of jetties, 2,553 of this amount being
including 791 feet of old log jetties rebuilt and repaired since October, 1884.

snagging operations were carried on between Fayetteville and a point 54 miles
. The work generally has been greatly impeded by very low water, with about
hes in the channel, and violent freshets [at present the river is 42 inches above
ater].

small amount of jetty work done is shown in detail in the yearly-progress maps
panying this report.*

---

* Omitted.

The river was navigable for about a month longer in low water this year t
by the action of the jetties, exclusive of the aid afforded by the frequent fre
The deep water at the upper end of Fayetteville Shoals has been prolonge
stream about 600 feet, so that it is now 1,800 feet long. There has been a sli
ing in the channel between Jetties 2 and 3. These two jetties are 400 feet ap
leave 120 feet channel width. The lower end of Fayettville Shoal, where the
leave 80 feet channel width, is deepening, and I believe will have a good dep
this winter's heavy freshets.

The steamboats have been stopped a few days on account of the heavy fresh
ice, and two months on account of low water; in 1884 they were stopped ab
months on account of low water. The following shoals remain to be survey
Flat (9½ miles below Fayetteville), Cedar Creek (11 miles below), Edward's I
(14 miles below), Jno. Hare's (16 miles below), Gray's Creek, or Devane's Fe
miles below), Jackson's (17½ miles below), Sike's (19 miles below), Brown's I
(43 miles below), Waddell's Ferry (44½ miles below), Phebus's (46½ miles belo
Sugar Loaf (48½ miles below), Little Sugar Loaf (49½ miles below), Horse P
miles below), Cypress (51½ miles below), Hammond's Creek (53 miles below)
by's (55 miles below), Mrs. Johnson's (56½ miles below), Whitehall (60½ miles
Johnson's Timber Landing (61½ miles below), Donahoe (63 miles below), Rol
Landing (64½ miles below), Brown's Reach (65½ miles below). These shoals a
from 12 inches to 18 inches draught at dead low water do not give as much
to navigation as those under survey.

Should the present system of jetties be carried out on all the shoals, I thin
what I have seen of the river since 1884, that there would be a continuous nav
eleven months per year, at least for 30 inches draught.

The largest steamboat draws 26 inches without any freight, 5 feet when fully
the other boats draw about 24 inches light; the flats draw 9 inches light, an
100 bales of cotton puts them down about 4 inches; as long as there is sufficier
the boats and flats go fully loaded, and I believe if the river was improved th
of goods transported would gradually increase to $4,000,000 per year, includin
goods.

The launch does all the Government towing, and is the only boat that can
the river during low water; she needs new and more powerful machinery; he
is very old and has a great many soft patches on it.

The greatest known freshet was between 50 feet and 55 feet above dead low
Fayetteville; the slope of the river at low water is about 4 inches per mile; de
water discharge at Fayetteville about 200 cubic feet per second.

Very respectfully, your obedient servant,

CHAS. HUMPHRE
Assistant En

Capt. W. H. BIXBY,
Corps of Engineers, U. S. A.

L 8.

IMPROVEMENT OF CAPE FEAR RIVER, BELOW WILMINGTON, N CAROLINA.

The Cape Fear River, emptying into the Atlantic Ocean at Cap
has, from its mouth up to its headquarters in the mountains,
length of about 426 miles and a drainage area of 9,115 square
The two main branches of the river meet at Wilmington, bringin
them an average fresh-water discharge of 14,000 cubic feet per
Below Wilmington the river is a tidal basin, with about 26 miles
350 square miles drainage area, 37 square miles water-surface,
rise of tide (2.5 at Wilmington, 4.5 at the ocean) and an average dis
during ebb of 160,000 cubic feet per second, the ocean bar being
seaward of the river mouth. The Cape Fear River below Wilmi
when placed under governmental improvement in 1829, had 3
trances with least depth as follows: About 9 feet at the Baldhead
nel, 9 feet at the Rip Channel, and 10 feet at New Inlet Channel
bars being, respectively, 9, 6, and 2 miles below the point which w
the river's delta. From the head of this delta 20 miles, up to W

n, there were several shoals with a least depth of 7.5 feet at low water. The original projects of 1827 to 1847 proposed to improve the upper miles by dredging and by jetty contraction of the channel; $203,204.59 ere spent during this time in increasing the depth upon the shoals to 5 feet at low water, equal to that at the bar entrances.

At or about this time, the shore at Fort Caswell, opposite Baldhead oint, was protected by stone jetties, under an appropriation for the eservation of fortifications.

The projects of 1852 to 1857 proposed to deepen the water at the main trance by jetties at Baldhead Point, and by jetty and dike obstrucns between Zeke's Island and Smith's Island, near New Inlet, and ggested the possible future necessity of closing New Inlet; $156,296.26 as spent during this time upon these works, never fully completed for nt of funds. The great storm of 1857 almost completely destroyed e Zeke's Island work, and the storms of 1871 cut through behind the ldhead Jetty (now termed the Woodbury Jetty), leaving it about 1,000 et out at sea.

The project of 1870 proposed for $257,000 a crib-closure of the space 403 feet long) between Smith's and Zeke's Island (finished in 1873), prevent further widening of New Inlet. The projects of 1870 to 1872 oposed for about $300,000 the complete closure of New Inlet (begun 1875 and finished in 1881), in order to deepen the water at the main aldhead) bar entrance.

The projects of 1872 to 1883, as continued to date, proposed for $160,000 e extension of the New Inlet Dam 2 miles further down the stream, to revent the further erosion of Smith's Island at the Swashes. The project of 1875, as continued to date, proposed for $36,000 the occasional e of dredging upon the outer bar to assist the tidal currents in gradlly localizing, straightening, deepening, and fixing the bar entrances; 12,000 to obtain a 12-foot depth at low water, and $24,000 more to obtain a 14-foot depth. The projects of 1874 to 1881, for the 20 miles above New Inlet, as continued to date, proposed $960,000 to be used in dredgg and occasional diking wherever necessary across shoals, so as to secure for $247,000 a 12-foot channel 200 feet wide, and afterward, for 713,000 more, a 16-foot channel 270 feet wide at low water, over this hole length. The aggregate amount of the original estimates for the xisting projects of 1870 to date is about $1,713,000; that of the revised stimates to date is about $2,110,000, the difference being $400,000. This $400,000 excess during sixteen years is chargeable, about $300,000, o unexpected engineering difficulties (such as presented by the excesive settling of foundations at New Inlet Dam, the necessity of raising his dam above high-water level, and the discovery of a forest of submerged stumps in the way of the desired dredged channels in the river-ed near Wilmington, &c., the necessity of a training-wall at Snow's Marsh Channel), and the other $100,000 to the inadequate yearly appropriations (involving loss from damage to unfinished work, care of property, extra superintendence, and deterioration of plant while awaiting unds, extra surveys, &c.). The present estimate, $2,110,000, for the inal cost of the work exceeds that of last year by about $28,000, due artly to the consideration of a shoal in the river in front of Wilmington ot heretofore estimated for, and the rest to the omission of the usual early appropriations for the last fiscal year (involving losses as above numerated). The aggregate amount appropriated for the existing projects of 1870 to 1882 up to the 30th June, 1886, is $1,702,500.

One million six hundred and ninety-eight thousand four hundred and even dollars and seventy-four cents have been spent in all up to 30th une, 1886, upon the *proposed improvements* of 1870 to 1882, with great success, obtaining a 13.5 to 14 foot least depth of water at the ma entrance, and completing to partial width the desired 16-foot c 28 miles further, to Wilmington. This depth, combined with the av rise of tide of 4.5 feet at the bar and 2.5 feet at Wilmington, is such at present, vessels loaded to 16 feet draught can readily go from mington to the ocean in a single tide any day of the year.

The total commerce, exports and imports, foreign and coastwis increased from about $13,400,000 of transported goods in 1870 about $17,000,000 in 1886 (all this increase being foreign comm showing that each dollar spent on this improvement has already accompanied by the development of about $2.40 of annual foreign merce, although the last increase of 2 feet in draught in the river- nel is too recent to have produced its natural effect on such dev ment.

The navigation of this river below Wilmington is not obstructe bridges of any sort.

The special work of the past fiscal year was as follows:

Expenditures, $66,052.81.

As far as possible all work has been done by contract.

At the shoals.—From July, 1885, to February, 1886, under an u ished contract with Mr. Rittenhouse Moore, the work of dredging continued at the Brunswick River, Big Island, and Lilliput shoals, Snow's Marsh Channel. Three hundred and twenty-five thousan hundred and forty-nine cubic yards of sand and mud, 118 large s and 5 logs were removed from the river-bed so as to complete a c through all of these shoals and marsh about 6 miles long, at least deep at low water, 111 feet wide everywhere, and 148 feet wide bends. The several reaches of this channel were all marked by of high guide piles driven in the river and large range-targets ere the neighboring shore. Further work was prevented by want of

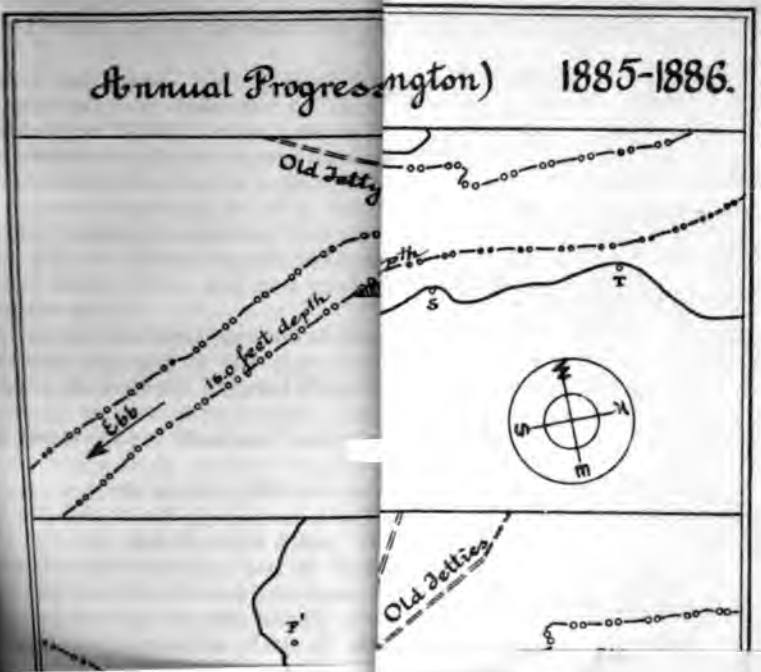
At the dike.—During July, under an unfinished contract with Z. French, 644 tons of heavy stone were received. This ston placed in position upon the dike extending southward from Zeke and, thus raising the dike everywhere to ordinary high-water lev making it of nearly uniform strength throughout. Further work wa vented by the want of funds. The heavy storms of August and Oct 1885, sent the water about 5 feet over the top of this dike, damagi considerably over 2 miles of its length by knocking down its ce ridge to a level of about 2.5 feet below ordinary high water. Consi ing the unfinished condition of the dike, it is surprising no more se damage was done. The dike was repaired as well as possible by distribution of the remaining stone. Twenty-two thousand more of stone are needed to complete this dike.

In the river.—From December, 1885, to June, 1886, a careful hy graphic survey was made of about 11 miles of the river to determine condition of its shoals at and in front of the city of Wilmington, at of the various places where channels have been dredged, and at the entrances.

At all places, except Snow's Marsh, this survey shows so slig shoaling in the various dredged channels as to indicate that the currents will be able of themselves to maintain the present channe the depths as now dredged.

At Snow's Marsh the survey shows a tendency of the river and o currents to cut across and through the shoal between the Snow's M Channel and the old Horseshoe Channel.

At the main (Baldhead) bar entrance, the survey shows a decided t ency of the ebb current to cut a deep channel from Baldhead I



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ight to the ocean. Along the line of this possible straight channel bar has already deepened to 11 feet least depth, and is now only feet long at 14 feet depth and only 1,400 feet long at 18 feet depth. tle assistance by dredging during the coming year might enable ebb current to secure at once a straight 14-foot channel direct to the n, increased perhaps to 15 or 16 feet permanent depth along this The existing channel of 13.5 to 14 feet least depth at mean low r is in a far better condition than last year, as it now has as much 0 feet least width, and now makes but two courses from Baldhead t to the sea.

pon the various beaches around Smith's Island and the river's mouth gradual changes of the past year show favorable results almost ywhere, as follows: Federal Point, Caroline Shoal, and Zeke's Island iderably increased in extent; New Inlet rapidly shoaling and now st closed; the "Swashes" continuing to close upon each other and the neighboring parts of Smith's Island so as to strengthen thems and re-form about 1,000 feet to the westward of the former oceanh line, thus tending to form a solid and continuous breakwater be the ocean and the new dike; Baldhead Point commencing to re its former shore line out to the old Woodbury Jetty; Baldhead t Hook lengthened and broadened and its inner basin shoaling, and Island and its channel hardly changed.

large and expensive plant of steamboats, hoister, and scows has cared for as well as is possible when such a plant is not in use, but damage from unavoidable rot, rust, and general decay, due to the of appropriations for active work, will probably exceed $7,000.

ll the above work has been thoroughly and vigorously carried on r the immediate superintendence of Assistant Engineer Henry on, whose full report is appended.

carefully condensed history of past work upon this improvement prepared by myself and forwarded in December of the past year. opy of the text is appended.

ecommendations for future work are as follows: That the above imvements be carried on as originally projected, by completing the unhed dike south of Zeke's Island, so as to thoroughly secure Smith's nd from further erosion by the ocean; and by widening and deepen the existing river channels to their full dimensions of 270 feet width 16 feet least depth at low water; and by further protecting them inst subsequent deterioration by submerged stone dikes where necary, and by straightening, deepening, and fixing the bar entrance, a total expense of $407,000 in addition to the $4,808.26 available e 30, 1886, this whole amount to be appropriated in one sum dur the next fiscal year. Smaller yearly appropriations, involving the ernate disorganization and reorganization of working parties, dam to unfinished work, deterioration of plant, and extra superintende, will increase the cost of the work by from $6,000 to $20,000 per propriation. So far as can be seen at present, the above will comte all existing projects for this improvement.

After the improvement is finished its proper maintenance may cost n $5,000 to $15,000 per year, for a few years, but the improvement uld be fairly permanent.

This improvement as regards cost and order of work should be card on approximately as follows, (prices, including superintendence d contingencies):

Eight thousand four hundred dollars for the thorough repair of suc-dredge, steam tug, and scows.

Fourteen thousand four hundred dollars for the operation of
tion-dredge 12 months upon the main bar entrance.

Sixty-eight thousand seven hundred dollars for the compl
the dike extending from Zeke's Island southward to Smith's Is

Nine thousand six hundred dollars for dredging through a
the river in front of the city of Wilmington.

One hundred and ninety-eight thousand dollars for increas
present narrow 16-foot depth dredged channels to their full p
width of 270 feet.

One hundred and eight thousand dollars at Snow's Marsh, to
nently secure the present depth at this point, either by a dike
tect its eastern bank from wearing down, or by suitable dredgi

This river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1885, amount available		$7
July 15, 1885, amount received from sales to Beaufort Harbor		
		7
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$65,124 33	
July 1, 1886, outstanding liabilities	925 48	
		6
July 1, 1886, amount available		
Amount appropriated by act approved August 5, 1886		1
Amount available for fiscal year ending June 30, 1887		1
Amount (estimated) required for completion of existing project		2
Amount that can be profitably expended in fiscal year ending June 30, 1888		2
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.		

HISTORY OF PAST WORK—IMPROVEMENT OF THE CAPE FEAR
BELOW WILMINGTON, NORTH CAROLINA. (BY CAPTAIN W. H.

GENERAL FEATURES OF THE RIVER.

The two branches of the Cape Fear River meet at Wilmington
bring down to Wilmington a fresh-water discharge of about 5
feet per second on an average during the three low-water mon
about 18,500 cubic feet per second during the nine flush-water
or about $14,000 cubic feet per second on an average through
entire year. At Wilmington the river has a cross section of abou
square feet, so that the height of its water-surface at this point
approximately unaffected by the variations in the amount of th
water discharge. Both branches are subject to tidal influence f
tance of about 30 miles above Wilmington.

From Wilmington to the ocean, 26 miles, the Cape Fear Ri
tidal-basin of about 37 square miles area, in which the tide ri
falls about 2.5 feet at Wilmington and 4.5 feet at the ocean, or a
feet on an average. At the river's mouth, 1.25 miles wide, the an
water which must pass to and fro each tide is therefore about
cubic feet per second. The ocean bar is about 2 miles to the sea
the river's mouth.

ORIGINAL CONDITION, PRIOR TO IMPROVEMENT.

nprovement of the Cape Fear River below Wilmington has been he consideration either of the State of North Carolina or of the States since 1821.

to 1761 the Cape Fear River was reported as allowing vessels et draught to pass over its main bar at low water and to enter the the same route as they follow to-day. In 1761, however, dur iolent equinoctial storm of four days' continuance, the wind and le a breach, reported at first as 18 feet deep at high water, and not over 2.5 feet deep at low water, and nearly half a mile wide, the sand-banks into the Cape Fear River about 8 miles above ner bar entrance, at a place called Haulover. This breach, off 6 miles of the river's length, gradually increased in impor as to form a new mouth to the river, deepening from 6 feet at ter in 1797 to 10 feet at low water in 1839, and received the f New Inlet. The effect of this new mouth upon the river was nish the depth of water upon the main bar entrance from 15 feet to 9 feet in 1839.

ast and present condition of these bars is shown in the follow e, the depths being expressed in feet and being (according to the tainable information) reduced to low water. (See three maps led with original report in December, 1885, to Chief of Engineers.)

Name of author of map.	Date.	Main outlet.		New inlet.
		Baldhead Channel.	Rip or Bulkead or shoalest part of western channel.	
oseley	1733	14	3	Closed.
imble	1738	16	4	Closed.
otts	1797	15	3	6
earney, Topographical Engineers	1820	10.5	3	6.5
lynn, United States Navy	1839	9?	9	10
others	1850	8	9.5	7
vey, Captain Maffit	1851	8	7	8
vey, Captain Maffit	1852	7.5	7	8
vey	1866	8	8	7.5
	1871	6.5	8	8
	1872	8	8	8
	1877	9.6	7.5	8
tates Engineers	1883	14	....	Closed.
	1885	14	....	Closed.

r to the opening of New Inlet, and even until 1839, Baldhead el was the natural and main entrance to the river. From 1839 2 both the Rip and New Inlet were the main entrances, and the Baldhead was discontinued. Since 1872, and the closure of the nlet, Baldhead has again become the main channel, and has been lly regaining its former depths.

821, the date of the first detailed survey of the river, vessels of feet draught were obliged to lighter their cargoes 14 miles below ngton, 10 feet draught at high water, and 7.5 feet draught at low being all that could be carried from the point of lighterage up to ngton.

From 1822 to 1829 the State of North Carolina attempted to the channel between New Inlet and Wilmington, by dike closur minor channels, by jetty contraction of the main channel-way, by dredging across the shoals. A small amount of money (sup have been from $60,000 to $80,000) was spent in this way, wi erately good results.

In 1826–'27 the United States made a careful survey of the po the river from Wilmington to New Inlet and a partial surve river mouths.

In 1829, when the United States Government assumed active of the improvements, the river had three bar entrances with least about as follows: 9 feet at the Baldhead Channel, 9 feet at the Ri nel (both near the old river mouth), and 10 feet at the New Inle nel; these bars being, respectively, 9, 6, and 2 miles below th which was then the head of the river's delta. From the head delta 20 miles up to Wilmington there were several shoals with depth of 7.5 feet at low water.

HISTORY AND CHARACTER OF THE GOVERNMENT WORKS, THEI AND THE RESULTS OBTAINED THEREFROM.

From 1829 to 1847, inclusive, $203,228.92 were appropriated proving the river between Federal Point and Wilmington. Th jects of 1829 to 1847 proposed to carry on the dredging and jett traction of the channel in general accord with the principles a outlined by the State engineer. Two hundred and three thousan hundred and four dollars and fifty-nine cents were actually spe ing this time with moderately successful results, increasing the upon the shoals by about 2 feet, so as to obtain 9.5 feet at low a depth equal to that at the bar entrances.

At or about this time the shore around Fort Caswell, at the river entrance, was protected by stone jetties, having in specia the preservation of the site of the fort and its shore lines, whic rapidly receding.

From 1852 to 1854 $160,000 was appropriated towards the im ment of the mouth of the river. The projects of 1852 to 1857 pr to carry on this improvement by the use of jetties (afterwards b 1853–'55, by Captain Woodbury) to hold Baldhead Point, and o obstructions to close the small inlets through Zeke's Island and f east between Zeke's Island and Smith's Island, on the south side Inlet; and they suggested the possible future necessity of closin Inlet. One hundred and fifty-six thousand two hundred and six dollars and twenty-six cents were spent during this time in completing these proposed works. The sea cut through behi jetty at Baldhead Point in 1871, and the jetties south of New Inl nearly destroyed in 1857 by the great storm of that year. Mea the water on the Rip Bar entrance was temporarily deepened by 1 foot, and on the Baldhead Bar entrance was shoaled for about

From 1870 to date $1,702,500 were appropriated for the impro of the river both at its mouth and above as far as Wilmington the mouth of the river: The projects of 1858 to 1872 proposed closure of the space (4,403 feet long) from the head of Smith's to Zeke's Island. The projects of 1870 to 1872 proposed the co closure of New Inlet (begun in 1875, finished in 1881). At th pletion of these proposed works the least depth of water upon th entrance (Baldhead) was found to be 13 feet at low water. Th

1875, as continued to date, proposes the occasional use of dredg-
on the outer bar to assist the natural action of the tidal currents
gradual localizing, deepening, and fixing of the bar entrance.
ts of 1872–'73, as continued to date, proposed the extension of
w Inlet Dam 2 miles further down the stream to prevent the fur-
rosion of Smith's Island at the Swashes. For the 20 miles above
nlet: The projects of 1874–'81, as continued to date, proposed
ng wherever necessary across shoals, so as to secure first a 12-foot
el 200 feet wide, and then a 16-foot channel 270 feet wide at low
over this whole length. The latter depth, combined with the
e rise of tide on the bar (4.5 feet) and at Wilmington (2.5 feet),
ive a good 18-foot navigation at high water from the ocean to
ngton.

million six hundred and thirty-two thousand three hundred and
ight dollars and ninety-three cents have been spent in all up to
0, 1885, upon the proposed improvements of 1870–'82, with com-
uccess, obtaining a 14-foot least depth of water at the main bar
ce, and completing to partial width the desired 16-foot channel
es further to Wilmington. The lighterage, formerly a necessity
4 miles of the river, is now entirely given up, and all vessels that
oss the outer bar now proceed directly to Wilmington to unload.
as possible all the work of improvement has been done by con-

foreign commerce has increased from about $1,500,000 exports
ficial statistics in Annual Report of 1874) in 1871, to about $5,000,-
ports in 1885. The total commerce, exports and imports, foreign
astwise, is now about $18,000,000 of goods per year.

ANNUAL APPROPRIATIONS.

annual appropriations for this work have been as follows:

State of North Carolina:	
2 to 1829, unknown, estimated at	$70,000 00
United States:	
6, for surveys (about)	1,000 00
rch 2, 1829	20,000 00
ril 23, 1830	25,688 00
rch 2, 1831	25,705 00
ly 2, 1832	28,000 00
rch 2, 1833	28,000 00
ne 28, 1834	5,234 00
rch 3, 1835	20,000 00
ly 2, 1836	20,000 00
rch 3, 1837	10,000 00
ly 7, 1838	20,000 00
rch 2, 1847 (deficiency)	601 92
Total, 1829 to 1847	203,228 92
gust 30, 1852	20,000 00
ly 22, 1854	140,000 00
Total, 1852 to 1854	160,000 00
ly 11, 1870	100,000 00
rch 3, 1871	75,000 00
ne 10, 1872	100,000 00
rch 3, 1873	100,000 00
ne 23, 1874	150,000 00
rch 3, 1875	150,000 00
gust 14, 1876	132,500 00

[illegible]—continued.

[illegible]	$1
[illegible]	1
[illegible]	
[illegible]	1
[illegible]	2
[illegible]	2
[illegible] 1885	1,7
[illegible] States from 1829 to 1885	2,0

[illegible], for an individual year, equaled [illegible] charge. The lack of sufficient funds, [illegible] were most needed, has caused to the [illegible] and money. The progress of th [illegible] hampered and the development of the ri [illegible] retarded.

[illegible] EITHER BY SUCCESS OR FAILURE

[illegible] 1829 by the State, under Mr. Fulton a [illegible] the water in the main channel and [illegible] the commencement of an important riv [illegible] works constructed by him, one dike, t [illegible] Island and the mainland on its west, v [illegible] to scour a channel east of that island [illegible] slowly, and the expected results w [illegible] the existence in the desired channel [illegible] stumps. These logs and stumps ha [illegible] expense.

[illegible] 1829 has been done by the United Stat [illegible] other than being successful, posses [illegible]. The eight jetties, constructed und [illegible] in material improvement to the m [illegible] the depth of water in the main chan [illegible]

[illegible] New Inlet was tentative, and t [illegible] was valuable as indicating a solutio [illegible] and recommended by that of 1858, vi [illegible] accidental outlet and the concentration [illegible] into the original and natural mai [illegible]

[illegible] constructed by Captain Woodbury in 18 [illegible] in tolerable permanent condition [illegible] shore end was flanked by the sea in 187 [illegible] water and nearly 1,500 feet in adva [illegible] Between the jetty and the shore the wate [illegible] This jetty was originally built to protect [illegible] rapid erosion by the waves and cur [illegible] that object until 1870, the date of comm [illegible]. Its effect, if any, upon Baldhead a [illegible] with certainty.

[illegible] from the head of Smith's Island west [illegible] experimental jetty or deflector at Fe [illegible] and extended from Federal Point south [illegible] recommended by the Engineer Board of [illegible] occasionally 12 feet deep) under l

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with solid bottom, and around the advancing ends of dikes in pro-
f construction, especially if the cribs or dikes are raised at first to
ight. It showed also the advantage of open bottoms for such cribs.
licated the method later used in the closure of New Inlet, viz, the
t first of mattress foundations and low submerged riprap dikes
ly across the place to be closed, to be followed afterwards by a
al elevation of the entire dike, commencing always at the shore

It showed also the ease with which sand-banks can be raised
al feet by planted sea-oats, by catch-fences, and by brush, and at
ame time the necessity for further protecting such artificial banks
st subsequent high storm tides and waves. The original closure
Zeke's Island eastward to Smith's Island, that of 1852–'57, was at-
ted by means of a continuous line of very heavy stone riprap, ef-
being made to assist the rapidity of the construction by the tem-
y use of auxiliary perpendicular jetties or piles, sheet-piles, brush,
and-bags. The second and final construction of 1870–'73 consisted
continuous line of wooden cribs loaded with smaller stone. The
with vertical sides were used from motives of economy to avoid
ecessity of excessive side slopes of stone-work, timber being cheap
tone expensive in this locality. Subsequent experience in the im-
ate vicinity of this work leads to the belief that the only error of
rst method of 1852–'57 was a mistaken economy in the amount of
riprap used. The final closure, 4,403 feet in total length, which
ot actually commenced until the fall of 1870, was finished in 1873,
approximate cost of $60 per linear foot, and with great success.
ea-beach to-day (1885) has moved away from it on both sides to a
ace in many places of several hundred feet; and the least depth of
in the Baldhead Channel was about 9 feet at low water, in 1875,
st 6.5 feet at low water in 1871. The 1871 survey showed Bald-
Point as receding. Subsequent surveys, while showing neither
nor loss at the Rip Channel from 1871 to 1872, did however show a
in the Baldhead Channel from 6.5 feet in 1871 to 8 feet in 1872,
o about 9 feet in 1875. These works were moreover needed as a
ninary step to the closure of New Inlet; but the latter's completion
81, together with the construction of the new dike from Zeke's
d southward to Smith's Island in 1883–'85, have rendered unneces-
the maintenance of that part of the old work which lies on the
ard (the ocean side) of the new dike.

1873–'74, a steam-propeller (Woodbury), of 145 tons burden was
up as a suction-dredge (with a double oscillating 10-inch cylinder
e, driving a 9-inch centrifugal pump, and with sand-bins of 40
yards capacity), and proved so successful that it dredged sand in
.4 feet of water upon the bar entrance in all kinds of weather at a
f not over 16 cents per cubic yard. This steamer was afterwards
deled and its suction-dredge apparatus much altered and improved.
tered, it worked more easily and rapidly than before, so as to dredge
pass through its bins as much as 656 cubic yards of sand in one
at a cost of not over 15 cents per cubic yard. The usefulness of
dredge, however, is not to be measured merely by the quantity of
passed through its bins, inasmuch as its drags loosen and stir up
the channel-bed a large quantity of material, which is carried di-
into the adjacent deep water by the river and ocean currents.

work of 1875 to 1881, upon the closure of New Inlet, deserves
ial note, as it resulted in such complete success. At the inlet the coast
as being re-established, and a shoal, 1.5 miles long and several hun-
eet broad at high water, now completely crosses the old bar entrance

of the inlet. At the mouth of the river the least depth of wat Baldhead Channel was 14 feet at low water in 1883 against abou at low water in 1875. This closure was made of moderately sma riprap, laid originally on log-and-brush mattresses, and capped wi fully-placed heavy stone (weighing from ½ to 4 tons per piece); th stone (one manstone) being used from motives of economy, and th heavy stone being used as a protection against storm-waves. T and-brush mattresses were used from a desire to utilize the mate the country, and because they were one of the elements of cheap the bid of the successful contractor.

These mattresses were made of pine logs cut in the creek i hand, formed into rafts of proper dimensions, loaded with as muc brush as they would carry, towed directly to their places, and su stone thrown upon them from scows. The middle portion of th (a lengh of 3,600 feet) is from 75 to 120 feet broad at its base, and average of 37 feet high; its side slopes are 1 on 1.5 in the river side on 2 in the ocean side. The whole dam is 4,800 feet long, contains 182,821 cubic yards of material, and cost, complete, about $498,0 about $105 per linear foot, or $2.75 per cubic yard. At present the difference often of 2 feet and sometimes of 3.4 feet between the water- of its river and sea side. During the construction of the dike the around its base, due partly to the river current, and partly to the fall, was so considerable, and the attacks of the teredo were so se that the log-and-brush foundations were to a great extent under or eaten up; in consequence, continual additions of stone ripra came necessary, so much so that practically the resulting founda consisted to a great extent of small stones. In view of this late perience it would seem that the use of small riprap stone founda from the commencement might have been simpler, quicker, mor cient, and cheaper than the use of the log-and-brush foundat although the latter were originally suggested by motives of econo

The work of 1883 to date, upon a dike from Zeke's Island south to Smith's Island, is the natural sequence of the work just desc After the closure of New Inlet the river appeared to be seeki second new outlet across Smith's Island Beach, south of Zeke's Isl through the so-called "Swashes" (made in the severe storm of 1 and an experimental attempt was made in 1881-'82 to close one of t swashes by an inexpensive work of round piling, sheet-piling, sand- and timber just in rear of the ocean front at the swash. A gale ing before the completion of the closure, the width and depth of the ing were so much increased that further attempts to complete the ure in this way were abandoned. The result of this unsuccessful e iment suggested the subsequent construction of a stone riprap closure along the neutral line between the ocean and the river, a 1.5 miles in rear of the ocean beach. This new closure, commenc 1883 and already raised to above low-water level, is so far succes and points to results similar to those that followed the closure of Inlet. This dike, 11,600 feet long and 7 feet wide on top, rests al everywhere on a brush-mattress foundation, in from 5 to 12 feet of w The brush mattress was built in sections, each 60 (or less) feet 2,610 (or less) feet long, and 12 inches in final thickness, and co place about 66 cents per square yard, or $2.65 per cubic yard. mattress is loaded with 52,000 cubic yards of stone. The dike (fou tion included) has cost so far $155,000, or less than $14 per linear About 22,000 cubic yards more of stone are needed to complete dike to the desired height (that of high spring tides) and to give i desired side slope of 1 on 2.

work of 1874 to date upon the river between its mouth and Wil-
on has been that of dredging only, and though eminently success-
results, possesses so far no features of special interest, except per-
the remarkable efficiency of the present clam-shell dredge in pull-
ormous stumps from their original bed at the bottom of the river.
eral parts of the river below Wilmington, at places 2,000 feet from
ore and where there is now 14 feet depth of water, stumps of trees,
s well as cypress, have been found firmly imbedded in the river
n in an erect position, apparently surrounded by the soil in which
riginally grew. Several theories have been advanced to account
se strange facts, such as that the ground has subsided, or has
ndermined since the death of the trees; but none of these theories
tirely satisfactory. The artificially dredged channel-ways of the
portion of the river have as far as possible been located along the
l of the current of the supposed natural channel. In a few cases
cross-currents could scarcely be avoided a certain amount of fill-
s taken place, and either a certain amount of training-wall or dike
s necessary to assist the moving water in retaining the desired
ion and present depth, or redredging must be occasionally resorted
d the final solution will be determined by the relative cost of the
ethods, as modified by the probability of future continued appro-
ns and the demands of navigation.

ome cases where one side or bank of the channel lies on soft ma-
in danger of erosion, a certain amount of diking, jettying or rip-
g may some day be needed to preserve the present sides or banks.

SUPERINTENDENCE.

improvement of the Lower Cape Fear River has been considered
scussed: in 1853 by Commission of Coast Survey, Navy, and Army
eer officers; in 1858, by a Commission of Coast Survey, Navy,
rmy Engineer officers; in 1871-'72 and in 1882, by a Board of Army
eers.

work under the State of North Carolina was directed by Mr.
ton Fulton, State engineer; that from 1827 to 1838 was directed by
Hartman Bache, Topographical Engineer, with Capt. George Bla-
orps of Engineers, as assistant; those from 1835 to 1839 were
l on by Lieuts. J. K. Mansfield, Corps of Engineers, John S.
r, First Artillery, Lieut. A. J. Swift and Capt. John McClellan,
l States Topographical Engineers; those from 1855 to 1857 were
l on under Capt. D. P. Woodbury and Lieut. W. M. C. Whiting,
of Engineers; those of 1870 under Col. James H. Simpson, United
Engineers, with Mr. Walter Griswold as assistant; those from
1884, under Lieut. Col. W. P. Craighill, United States Engineers,
apt. C. B. Phillips as assistant until 1876, and Mr. Henry Bacon
istant from 1876 to 1884; since 1884, under Capt. W. H. Bixby,
l States Engineers, with Mr. Henry Bacon as assistant.

MINGTON, N. C., *December* 18, 1885.

REPORT OF MR. HENRY BACON, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., July 24, 1886.

IR: I have the honor to submit the following report of operations for the
ment of Cape Fear River from the ocean to Wilmington during the year end-
e 30, 1886:

ailure of Congress to make any appropriation for the year prevented any un-
g of new work and the *continuance of the* work of the present project any

further than was embraced in the unfinished contracts for dredging an the care and preservation of the finished work.

At the beginning of the present year a small amount of stone remain livered to complete the contract of Mr. G. Z. French, which was done 1885, to the amount of 644 tons of heavy stone. This was placed on t dam, which was being constructed as a defense against the swashes of Sm This work, which is more than 2 miles in length, has been fully describ reports, and was left in substantially the same condition as at the last an The severe storms of August and October, 1885, did some damage to the d ing down the narrow central ridge from the level of ordinary high wat tides to 2.5 feet below over the greater portion of the dam, and thus some measure its present efficiency. It was repaired to some extent by r stone in the lowest places; but the general height was diminished by at This would have caused but little permanent damage, if the funds had be for continuing and completing the dam, as the stone was not scattered m of the proper foundation of the finished work.

The dredging under the contract with Mr. Rittenhouse Moore was comp extent of the funds which were properly available for it in December, 18 exception of a few stumps which were accidentally left behind, and were February, 1886, and a small amount of dredging also being done in the r

The following are the amounts of work done monthly, with the total each location:

Date.	Dredging.	Stum remov
	Cubic yards.	
July, 1885	49,405	
August, 1885	84,752	
September, 1885	51,303	
October, 1885	34,566	
November, 1885	52,723	
December, 1885	51,902	
February, 1886	798	
Total	325,449	
Amounts previous to July 1	321,925	
Total amounts of contracts	647,374	

The proposed width of channel on all the shoals is 270 feet.

The Brunswick River Shoal is about 5,000 feet in length in one straigh is finished to 111 feet width.

The Logs and Big Island Shoal is about 8,500 feet in length, in fou various lengths. It is finished to 148 feet width.

The Lilliput Shoal is about 11,000 feet in length in two reaches. It i 111 feet width, and at the angle for a distance of 1,000 feet each way t 148 feet.

All the dredging on the three shoals has been done to 16 feet depth water.

The Snow's Marsh Channel was dredged to 270 feet width and 16 feet de low water from August, 1881, to December, 1883. A considerable deteri very soon observed on the upper reach, over a great portion of its le slight decrease in depth at one point for a short distance on the lower dredging done during the past year on this channel was for repairs. As last report, the causes of the shoaling were the extreme softness of the and adjacent to the cut and the tidal currents which cross the channel angle both on the flood and ebb.

Two deep cuts were made along the center of the whole upper reach 5,500 feet, making a width of 74 feet, and a third cut was made on abo length, making a width of 111 feet. The dredging was done to fully 1 at low water to allow for the filling in from the sides of the soft material. of dredging on the upper reach was about 100,500 cubic yards.

The shoaling on the lower reach of the channel was directly opposite th ing known as the thoroughfare through the Snow's Marsh Islands, throug tidal basin in the rear of the marsh is to a considerable extent filled and this point 11,200 cubic yards of dredging was done to a width of 74 fee depth at mean low water and length of 700 feet.

ere has been very little, if any, deterioration in the other dredged channels. The
h of the several dredged channels is as follows:

	Feet.
's Marsh Channel	12,800
ight Shoal Channel	7,400
at Shoal Channel	11,000
and Big Island Shoal Channel	8,500
wick River Shoal Channel	5,000
Total length	44,700

8.5 miles.

amount of dredging done at the five locations named since the commencement
present project in 1881, for a channel of 16 feet depth at mean low water and
et width, is 1,877,344 cubic yards.

e hundred and seventy-two thousand two hundred and seventy-one cubic yards
lging was done on the Snow's Marsh Channel from September, 1874, to May, 1876,
e a channel first to 9 feet depth and then to 12 feet, at low water, and 200 feet
. This makes the total amount of dredging done to date 2,249,615 cubic yards
ling the comparatively small amount done in connection with clearing the
s and logs from the Big Island and Logs Channel in 1874 and 1875, of which no
was made, as the work was done by the day.

ing the past year the stumps and logs were extracted with comparative ease by
e of the ordinary bucket of the grapple-dredge after digging around them. In
exceptional cases dynamite was used to shatter them before removal. On the
, not so much trouble was caused or expense incurred in extracting the stumps
expected, but the job would probably have been nearly as profitable to the
ctor if no stumps or logs had been found. He was paid $40 for each stump or
trees 12 inches and upwards in diameter, and nothing for smaller stumps or
xcept as he was paid for their dredging.

r the dredging was finished, the areas where stumps had been found or expected
horoughly dredged over to the required depths to find any stumps or obstruc-
accidentally left behind. A few stumps were found, and were removed in Feb-
1886.

e the dredging was done at the several shoals, careful and exhaustive surveys
made at each place, which proved that the work in general has been well and
ghly done.

lifferent times from November, 1885, to February, 1886, an exhaustive hydro-
ic survey of the river in front of Wilmington was made and mapped on a
scale. This shows the exact position of the shoal. which extends from the
ence of the main and northeast branch to a point in the northeast branch about
feet above and in front of the city adjacent. It is proposed to cut a channel to 16
epth mean low water across this shoal, and an estimate is therefore appended.

different reaches of all the dredged channels have been carefully marked by
ange piles driven and shore marks erected.

xhaustive hydrographic survey of the entrance and the river from the bar and
ce to Reeve's Point was nearly completed in June, 1886. The main points were
ined trigonometrically with precision. All the soundings were located by one
t cutting on ranges previously located with accuracy. This method enables us
te soundings as fast as they can be taken—even in shoal water—often six per
e. The soundings in less than 28 feet depth were taken with poles and greater
with lead and lines. The distance from Reeve's Point to the outer bar is
10 miles. The area over which soundings have been taken is about 15 square
The number of soundings located is about 23,000.

work of the survey embraced all the shore lines where changes are occurring,
ing Federal Point, the new beach over the site of the Caroline Shoals, Zeke's
nith's islands, and the beaches at the swashes, Baldhead Point, and Oak Island.

weather has been remarkably unfavorable for the work during the last four
s, and this has prevented the completion of the survey and map at the end of
cal year.

is probably the most exhaustive and reliable survey of the whole entrance and
nd the portion of the river embraced which has ever been made as to the de-
f hydrography.

e of the results will be exhibited on maps being prepared to accompany the
l Report.

ery great improvement has occurred in the Baldhead Channel. It is now in a
condition than at any former time on record.

re is a wide and easily navigable channel across the bar and inner shoal from
a to the deep water of the harbor, with a least depth of 13.5 to 14.0 feet at mean
ater. The narrowest place, which is at the inner shoal, has a width of 350 feet,
t this point there is another passage of the same depth and 200 feet in width.

There is a small shoal between the two, on which the least depth is 12 feet. T no short turns to be made in navigating the channel, as heretofore. The harb of Baldhead Point can be made from the sea with two courses and 14 feet d mean low water.

The deep pocket referred to in former reports, which extends straight from o Baldhead Point past the inner shoals, is now within 650 feet of the deep wat the bar. That is to say, the 14-foot curve at mean low water on the sea-side side are about 650 feet apart. The 10-foot curves are about 1,400 feet apart. evident that the forces of nature tend to clear this passage through and sho artificially assisted. This can be done by the use of the suction-dredge Woo which was successfully employed on the channel from April, 1879, to October,

An estimate for its repair and operation is appended. The condition of t trance channel, as showing the good results of the improvement above, emb the thorough closure of the new inlet and the partial construction of long d very gratifying, and indicates a reasonable certainty that with the complet the dam and a proper jetty system at the entrance a low-water depth of 25 feet be attained by the force of the tidal currents to and from the great tidal rese It is probable that the opening of the deep dredged channels in the river at S Marsh and above does and will assist in the work by the acceleration of tid tion and increase of volume.

A comparison of the present condition of the bar and entrance with that as s by the survey and map of 1877 will show the great changes which have taken especially at the Baldhead Channel. In 1877 there was no well-defined chan the bar, but a least depth of 10 feet at mean low water could be found in de courses. From the somewhat elaborate Coast Survey map of Assistant W. I. of 1872, it appears that only 8 feet could be carried across the bar, and there wa same depth available at the "Rip" of the western channel. The western or Island Channel at the bar or inner basin appears to be in much the same conditi in 1872 and 1877. There is now, as then, about 14 feet depth at low water at the bar and 7 to 8 feet at the "Rip."

The changes in the shore-line of Oak Island are not great since 1877.

At Baldhead Point there has been a continuous erosion (misprinted "extensio the last report) on the sea-side ever since the stone jetty was flanked in 1871, bu distance across the entrance to Oak Island has remained the same. The hook o point has extended inward and beyond the light-house, and has thoroughly prot it. In previous years the light-house was in danger from the continuous erosi the shore on the inside.

While Baldhead Point has been worn away on the sea-side, a large accretion been going forward at the sea-shore southerly from the point, which is advancing considerable rapidity towards the old stone jetty, which is still in sight at low w while the shoal at the point is also tending towards the jetty. The prospect is a hook may at last extend from the accretion first mentioned to the old jetty, thus restore the point to its former condition.

The plotting of the survey is unfinished. Enough is done to show the conditi the channel from the bar entrance to Reeve's Point. The wide and deep channel Baldhead Point to the Horseshoe Channel Shoal, opposite Price's Creek, and the bor at Smithville, remain substantially as from the times of the earliest records.

The old channel, known as the Horseshoe, has been variable for many years. Price's Creek Light-House range now leads across a dry shoal at low water, w the channel was in 1850–'55. At the present time the greatest depth available is at low water, and the passage is so intricate as to make it difficult for navigation 7 feet draught at low water. It is not in present use, as there is fully 14 feet avai depth at low water throughout the whole length of the Snow's Marsh Channel, a feet, excepting at one point, in the lower reach before mentioned. The dredging in repair of the Snow's Marsh Channel from October to December 30, 1885, before tioned, proves thus far more beneficial then could have been expected from forme perience. Since then the most decided symptoms of deterioration are at the poi the lower reach last mentioned.

The passage between the marsh islands, before referred to as the source of trouble, should be closed. It would require not exceeding 2,500 tons of stone ri to bar the passage. There the tidal currents would then pass behind the islan fill and empty the basin and Walden Creek, and would not interfere with the channel.

Since the Snow's Marsh Channel has been opened there has been a tendency tow scouring passages across the high shoal above the Horseshoe, and between th channel and the new, so that now there are two passages with fully 6 feet least d at low water where there was less than 3 feet depth in 1877. These passages di from the new channel upward and are approximately parallel to the lower porti the Horseshoe Channel.

It also appears that there has been considerable shoaling since 1877 in the water known as the Five Fathom Hole, opposite and above the head of S

In 1877 there were depths of 30 and 31 feet at low water, where now the t depths are 26 and 27 feet.

middle ground between the upper reach of Snow's Marsh and the main chan- he Five Fathom Hole has continued to wear away, as stated in the last report, s will tend to increase the cost of the proposed jetty if there be further delay ng available funds.

e has been very little change in the shore-lines of Federal Point and Zeke's during the year. The long beach extending over the site of the Caroline from Federal Point Beach towards the head of Smith's Island, has widened m, and at the extremity has extended 500 feet nearer the head of Smith's Island, listant now 1,000 feet at high water. It is also 250 feet nearer Zeke's Island, ning being 1,250 feet of shoal water.

swashes of the Smith's Island Beach remain open, with the exception of the ly one, of the former reports, which is now entirely closed from natural causes construction of the new dam.

was by far the most dangerous opening on account of its proximity to the main l of the river. Its closure can be attributed with certainty to the partial con- n of the new dam.

e it was entirely closed, the beach at its northerly flank became quite narrow ak, from constant receding at the swash, and was finally broken by the sea e head of Smith's Island. From this breach, which has been greatly reduced, emains a small opening of less than 100 feet width at low water and 200 feet water. This would be dangerous but for the dam. It will undoubtedly be n or before the completion of the dam.

ong narrow sand-hook which at the beginning of the year extended from the ly side of the next or main swash, was flanked by the autumn storms of 1885, restoration is not fully completed, so that the width at high water is greater the beginning of the year, but the shoaling in the bay has increased.

ook at the southerly side of the south swash was also flanked, making the wider at low water. The sectional area of all the swashes has not increased lly. The total widths at high water and low water are 4,050 and 2,780 feet 2,930 and 1,700 feet at the beginning of the year.

mportance of completing the dam is apparent.

eries of projects which are now in the way of completion began with the ap- tion of 1870.

resent project embraces the completion of the dredged channels across all the where dredging is required to make 270 feet width and 16 feet depth at mean er; the completion of the long dam from Zeke's Island to the Big Marsh; the ction of the jetty or training-wall at the head of Snow's Marsh for the preser- of the dredged channel; the repairs of the dredged channels by dredging here has been deterioration; and the operation of the suction-dredge Wood- the Baldhead Channel.

dition to these, it is proposed to dredge through the shoal at Wilmington be- ntioned.

ollowing is the estimate of the amounts required for the completion of the

uld be remarked that on account of the plant lying idle for more than a year, erioration has been rapid and much greater than it would have been if con- employed. This is the case especially with the scows (14 in number) and the Woodbury.

undred and ninety-seven thousand cubic yards of dredging to com- the channels to Wilmington, at 14.5 cents	$130,065 00
ng 880 large stumps and logs, at $40	35,200 00
ubic yards dredging at Wilmington, at 20 cents	8,000 00
ons stone delivered to complete dam, at $2	44,000 00
labor, placing stone, at 60 cents per ton	13,200 00
ons stone delivered for jetty, Snow's Marsh, at $2	83,360 00
labor, unloading stone on jetty, at 15 cents per ton	6,252 00
100 piles driven, at $3	300 00
of the suction-dredge Woodbury	4,000 00
on of the Woodbury, 12 months, at Baldhead Point	12,000 00
of the steam-tug James T. Easton	600 00
of 14 scows and pile-drivers	2,000 00
	338,977 00
per cent. work and superintendence	33,897 70
per cent. for contingencies	33,897 70
otal	406,772 40

forward with this a letter from Mr. C. H. Robinson, collector of customs, in e states the amount of *revenue collected during* the last fiscal year, and gives

other valuable information, also a statement of the commercial statistics of
prepared with great care by Mr. A. H. Van Bokkelen, late president of the
of commerce, Wilmington, N. C. He deserves credit for the interest he has
the work and the public spirit he has for many years manifested.

The work is in the collection district of Wilmington, N. C. The neare
houses are at Baldhead Point and Oak Island, at the mouth of the river.

Respectfully submitted.

HENRY BACO
Assistant En

Capt. W. H. BIXBY,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

[Furnished by Mr. A. H. Van Bokkelen, ex-president chamber of commerce, Wilmingt

	Vessels.
Coastwise	274
Foreign	186
Total	460

Exports and imports.

Articles.		Foreign.	Coastwise.	
Cotton	bales	78,218	30,651	
Spirits turpentine	casks	48,757	22,140	
Rosin	barrels	288,499	44,195	
Crude turpentine	do	3	35,439	
Pitch Tar	do casks	9,075	63,542	
Sawed lumber	feet	9,053,000	28,729,500	3
Shingles	number	1,589,000	8,761,500	

1886, value of exports	$1
1886, value of imports	
Total	1

LETTER OF THE COLLECTOR OF CUSTOMS AT WILMINGTON, NORTH CAROL

CUSTOM-HOUSE, WILMINGTON, N. C., *July* 15

SIR: In response to your verbal request I give you below the transaction
office for the year ending June 30, 1886.

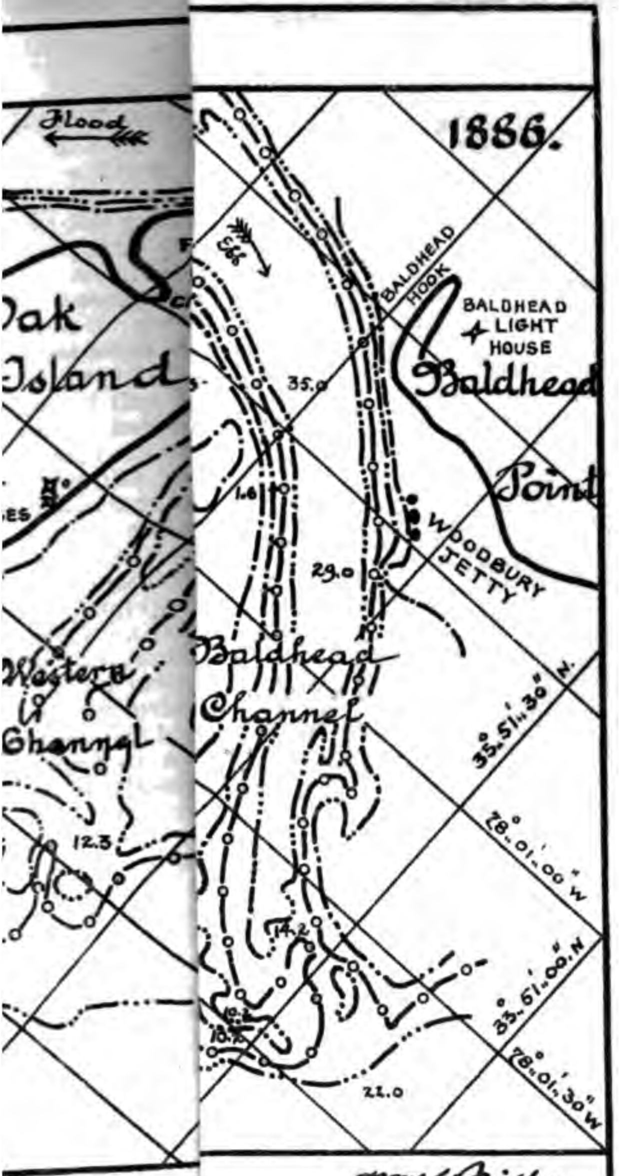
RECEIPTS.

Duties	$1
Tonnage	
All other	
Total	2

EXPORTS.

Domestic	$4,
Foreign	
Total	4,

Imports and warehouse entries	
Entries, foreign	
Clearances, foreign	
Entries, coastwise	
Clearances, coastwise	
Vessels documented	
Tons	



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20,000.

Wm H. Bixby
Capt. of Engrs.

12-fo Bacon in 1886; and
14 fo
18 fo accompany Ann. Rept. of 1886.
6 fo

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IMPROVEMENT OF GREAT PEE DEE RIVER, SOUTH CAROLINA.

The Great Pee Dee River, emptying into Winyaw Bay at George- own, S. C., has (including its upper portion called the Yadkin) a total ngth of about 500 miles and a drainage area of 16,329 square miles, f which 9,642 square miles lie above the mouths of the Black, Lynche's, nd Little Pee Dee, its main tributaries. At Cheraw, at a stage of 0.5 et above low water, its discharge is about 7,000 cubic feet per second. his river, prior to governmental improvement in 1880, was danger- sly obstructed with snags and logs everywhere. Otherwise it was ily reached at a point 41 miles above its mouth by 9-foot-draught boats ning by way of the Waccemaw and Bull Creek; thence it was navi- ble for the same boats 26 miles further, to Smith's Mills; and thence r 3.5-feet-draught boats at low water 88 miles further, to Little Bluff, at high water 183 miles further, from Smith's Mills to Cheraw, the esent head of steam navigation, 250 miles above Georgetown. The merce of the river is estimated to have then been $400,000 of goods nsported per year.

The original project of 1880, as continued to date, proposed for $25,000 secure a thoroughly cleared 9-foot navigation to Smith's Mills, and 3.5-foot navigation to Cheraw at all stages of water. This estimate s based on an examination required to be made hastily and inex- nsively. As regards logs and snags, the estimate allowed for only 0 in all (two per mile on an average); whereas as well as can now be timated over 1,000 logs and snags have actually been removed, and bout 6,000 more are awaiting removal (in all, 32 per mile). Moreover, ese logs are extremely large and their removal proportionately ex- nsive. Inadequate yearly appropriations involving the alternate dis- rganization and reorganization of working parties, damage to unfin- hed work, extra superintendence, and deterioration of plant have lded considerable to the cost of the work. The aggregate amount propriated for this project up to 30th June, 1886, is $27,000. The esent estimate (that of 1885), $117,000 for the final cost of the work, based on these later developments and personal examinations.

Twenty-six thousand nine hundred and nineteen dollars and forty- ee cents have been expended in all upon this improvement up to 30th ne, 1886, giving at all ordinary stages of water a well-cleared 9-foot igation 67 miles upward, to Smith's Mills; and a fairly-cleared 3.5- t navigation at low water 83 miles further, to the railroad station Pee Dee, or, at high water, 183 miles further, from Smith's Mills to eraw. The commerce of the river has been thereby increased so as be at present about $2,000,000 per year, showing that each dollar nt on this improvement has been accompanied by the development about $59 of annual commerce.

The navigation of the river is obstructed at points, as shown by the lowing extract from special report, dated January 17, 1885:

> bout 150 miles above Georgetown this river is crossed by the Wilmington, Co- bia and Augusta Railroad, on a bridge provided with a draw-span of suitable th. Projecting iron work on the piers, swift cross-currents in the river, and an roperly arranged piling fender combine to subject passing vessels to injury.
>
> everal miles above the railroad bridge the river is crossed by the toll-bridge of Society Hill Bridge Company on a through bridge provided with a draw-span of er width. Swift and strong cross-currents and the absence of suitable fenders bine to subject passing vessels to injury by the bridge piers.

I recommend that the owners of both these bridges be required to provid and suitable fenders at both ends of these draw-openings, these fenders exten feet above and below the bridge, and rising above ordinary high water to about a foot of the draw-span's lower chord.

The special work of the year is as follows:

Expenditures, $829.02.

Owing to its variable features, and the difficulty of properly s ing it beforehand and inspecting it afterwards, the work was all done by hired labor and the purchase of materials in open mark

A small survey was made of the river in June with a view of ing a map suitable for properly ordering and recording future This survey was very efficiently made by Assistant Engineer C Humphreys.

Other than this, and office work, and the care of the Gover property, nothing has been done for want of funds.

The general charge of the work has been under the immediate vision of Assistant Engineer Reid Whitford. His full report (inc a brief history of past work upon this improvement) is herewi pended.

Recommendations for future work are as follows:

That this improvement be completed in accordance with the approved and adopted project, so as to secure a thoroughly-cleared navigation 67 miles upward, to Smith's Mills, and thence a 3 navigation 183 miles further, to Cheraw, at all stages of water, at expense of $90,000, in addition to the $80.57 available the 30th Jun this amount to be appropriated in two yearly installments of and $30,000 respectively. Smaller appropriations will increa cost of the work from $2,000 to $5,000 per appropriation. Furt provement, so as to extend the navigation above Cheraw, is not mended for the present.

After the improvement is finished, its proper maintenance m from $2,000 to $5,000 per year to properly maintain the improve nel.

This improvement, as regards cost and order of work, should ried on approximately as follows: The entire length of river sh examined and improved uniformly each year. During the lo stage the most troublesome sunken logs and snags should be r from the channel. During the high-water stage the most troub leaning trees should be cut down and pulled back from the ba also such trees on caving banks as appear liable to fall into th channel during the following year.

This river is in the collection district of Georgetown, S. C.

Money statement.

July 1, 1885, amount available		
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$489 30	
July 1, 1886, outstanding liabilities	339 72	
July 1, 1886, amount available		
Amount appropriated by act approved August 5, 1886		2
Amount available for fiscal year ending June 30, 1887		2
Amount (estimated) required for completion of existing project		7
Amount that can be profitably expended in fiscal year ending June 30, 1888		6
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.		

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., June 3, 1886.

CAPTAIN: I have the honor to make the following annual report upon the improvement of the Great Pee Dee River to date.

GENERAL FEATURES.

This river is merely a continuation of the Yadkin.

The latter river in Watauga County, North Carolina, flows first easterly, then southerly, taking the name of Great Pee Dee, at the mouth of the Uwharie River, a small stream entering from the northeast, in Montgomery County, North Carolina, and joins its water with the Waccemaw, a short distance above Georgetown, S. C. This river traverses, possibly, one of the most fertile as well as the richest sections in both States.

Beginning in the country where minerals of various kinds abound, and after passing the small grain, fruit, tobacco, and gold belts in North Carolina, it enters the cotton belt in the State of South Carolina, and finally ends in the tide-water rice-lands near the sea-coast.

The valley of the Yadkin is noted far and wide for its fertility of soil and healthfulness of climate, as well as for its picturesqueness of scenery and thrift of people.

Many thousands bales of cotton and bushels of rice are annually harvested from the Pee Dee Basin and shipped to distant points.

"The Narrows" of the Yadkin, found about 6 miles above the mouth of the Uwharie, presents a most picturesquely grand scene.

Here the water is abruptly contracted from a width of about 500 feet to that of probably 60 feet, causing the current to rush with marvelous swiftness between walls of beautiful slate rock which lie in a confused mass along the edges of the "Narrows," and at the foot of the nearly vertical uprising cliffs.

There are two perpendicular falls in the Narrows, said to be respectively 6 and 8 feet.

A visitor at this place is at once struck with the superior magnitude of the inexhaustible water power everywhere visible, and wonders why it has been allowed to remain thus idle for so many years.

The possible length of this river from head to mouth is near 465 miles, affording means of drainage for a tremendous area of land. The low-water surface of the river all the way from a point a short distance above Cheraw to its head, is broken at intervals by falls and rapids. At some places the falls are vertical, the river being dammed for milling or fishing purposes, and at others the water roars over steep rocky beds with great velocity. Below Cheraw the slope is less, and the river-bed is generally free from rock or gravel shoals. Steamers run regularly as far up as that town without the least difficulty when there is sufficient water to admit of their passage over the sunken logs or sand-bars. During the past several years the United States Government has been endeavoring to improve that section of the Yadkin River stretching from the North Carolina Railroad Bridge, near Salisbury, to Bean Shoals, near Wilkesboro', a distance of about 64 miles. The improvement contemplated blasting a channel through the rocks, where there was not sufficient water for a class of small boats. It is thought that at present the work has only been partially completed over the first 20 miles.

HISTORY OF THE IMPROVEMENT OF THE GREAT PEE DEE.

1784.* An act of the South Carolina legislature appropriated £300 sterling to be expended in the removal of all obstructions as far up as the North Carolina line.

1785.* An act of the same legislature to improve the river from Euhany Ferry (38 miles estimated from Georgetown) to the North Carolina line, funds for this purpose to be collected by levying a special tax upon the lands lying along the river.

1791.* An act to improve the river between points mentioned in 1785 by requiring the male inhabitants of the adjacent county to work each six days in the year at removing obstructions.

1805.* An act of this year appropriates $4,000 for the improvement of the river from Britton's Ferry to the North Carolina line.

1815.* An act of this year was passed which provided for the improvement of the North Carolina line down to Singleton's plantation by the six days' labor plan.

1873.† The river was examined by General Q. A. Gillmore, Corps of Engineers, this year.

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*Extract from back acts of South Carolina legislature.

†See Chief of Engineers' Report for 1873, page 753.

1878.* An act of Congress, approved January 18, 1878, provided for a survey Pee Dee River from Cheraw to the mouth of the Uwharie; distance 67 miles. survey was made in December, this year, under the direction of Capt. Charles B. lips, Corps of Engineers, who only recommended that the first 20 miles above Cl should be improved.

1879. An act of Congress of March 3 provided for a survey of the river below raw.† The survey was made under the direction of Captain Phillips in Octol this year. . He recommended that the improvement be undertaken over this pa the river, and that the sum of $25,520 should be expended in carrying on the proj project, which contemplated removing the obstructions so that a depth of 9 feet a water might be secured from the mouth of the river to Smith's Mills, and 3½ feet that point to Cheraw.†

1880–'81. An act of Congress, approved June 14, 1880, appropriated $7,000 for work.‡ An act of March 3, 1881, appropriated $6,000 more.§ H. Heth, assistan gineer, was placed in local charge early in the autumn of 1880.

Capt. James Mercur, Corps of Engineers, assumed control of the work upon death of Captain Phillips, June 14, 1881. Work was begun at the "Pocket" lan with a hand-hoister, about 170 miles above Georgetown, 10th November, 1880, between that date and the 30th of the following June (the work had been interru by high water) there had been removed from the river 286 logs, besides some sı ones, and in addition the banks were trimmed of overhanging growth.‖

1881–'82. An act of August 2, 1882, appropriated $6,000 for this work. Work resumed in July, 1881, on the upper part of the river, with a hand-hoister. Afterwa the steamer Marian (subsequently used on the Wateree) was employed as a ste hoister, but proving too large and too deep for the river work her services were s dispensed with and work was again carried on by hand. From July, 1881, to Ju 1882, some logs were removed from the bed of the river and some overhanging gro cut.¶

1882–'83. Work was again begun in November, 1882, by a force of hands, trimm the banks of overhanging growth on the upper part of the river. A steam-hoi (Samson) also did some work between the mouth of the river and Smith's Mill, ceased operations 9th February following. No detailed statement of amount of w done is given.**

1883–'84. Work was suspended March 3, 1883, and there was no appropriation ing fiscal year ending June 30, 1884.††

Captain Mercur was relieved by Capt. F. A. Hinman in March, 1884. Reid W ford, assistant engineer, took local charge of this work under Captain Hinman, M 1884, vice H. Heth, assistant engineer, resigned.

Captain Hinman was relieved by Capt. William H. Bixby, Corps of Engine August 12, 1884.

1884–'85. An act of July 5, 1884, appropriated $8,000 for this work. Operati were commenced 7th October following at Fort Harrelson, and continued upward Tigerhead, a distance of about 160 miles. This hoister stopped work last day of tober, and went direct to the Wateree River to do similar work for the United Sta During the first days of next month a hand-hoister was converted into one of st for the United States, and started work at Dick Nalum's Landing, 133 miles ab Georgetown. This machine worked nearly over the entire lower part of the ri and was laid up for want of funds on the 30th of the following April. Early in F ruary, 1885, a new steam-hoister, furnished by Skinner & Ferris, of Wilmington C., was started at Cheraw, and when she was laid up, May 30 following, she worked roughly over the whole length of the river. In this way there were remo during the fiscal year ending June 30, 1885, a total of 452 large logs from 1 to 5 in diameter and from 20 to 90 feet long, 152 stumps, 35 cords of snags, and 1 barre rosin from the bed of the channel, and 972 trees and 840 linear feet of brush clea from the banks where they overhung and obstructed navigation.‡‡

Captain Bixby revised the estimates of the probable cost of completing this provement, and recommended a further expenditure of $90,000, in order that the de desired in the original project might be secured.§§

1885–'86. No work has been done since the end of the last fiscal year to date of report, except an examination of the river, which was made in May, 1886. During progress of the work, regular trained pilots of the South Carolina Steamboat C pany for this river were employed to work on the hoisters; and the hoisters were required to remove such obstructions as in the opinion of these men hindered navigation. It is generally admitted by those whose business it is to run boats on the river that the stream has been much improved by the above work. Unfortunately, operations were required to cease for want of funds The navigation of this stream will be greatly improved, and the commerce immensely increased by continuing the improvement.

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* See Chief of Engineers' Report for 1879, page 723.

† See Report of Chief of Engineers for 1880, page 845.

‡ See Report of Chief of Engineers for 1880, page 844.

§ See Report of Chief of Engineers for 1881, page 1030.

‖ See Report of Chief of Engineers for 1881, page 1029.

¶ See Report of Chief of Engineers for 1882, pages 1107 and 1108.

** See Report of Chief of Engineers for 1883, pages 866 and 867.

†† See Report of Chief of Engineers for 1884, page 1047.

‡‡ See Report of Chief of Engineers for 1885, page 1100.

§§ See Report of Chief of Engineers for 1885, pages 1100 and 1101.

The following have been the appropriations to date for this work:

1784. By State of South Carolina, £300	$1,500
1785. By State of South Carolina	4,000
1880. By the United States	7,000
1881. By the United States	6,000
1882. By the United States	6,000
1884. By the United States	8 000

The above shows that at intervals the work has been carried on for the past hundred years.

RECOMMENDATIONS FOR NEXT SEASON'S WORK.

It is respectfully recommended that work be done first in preference between the mouth of the river and Smith's Mill, by removing logs and cutting overhanging trees in the way of tug-boats and sea-going vessels. Between Smith's Mill and Dick Nalum's landing for the river steamers the same character of work is needed, and for the same purpose between the Wilmington, Columbia and Augusta Railroad Bridge and Cheraw. It is further recommended that river pilots be employed with each hoister, when possible to get them at a reasonable compensation for their services, and that only logs and snags be removed from the river at low water and the overhanging growth be cut at high water; that no attempt be made to thoroughly clear any portion of the river during the first working over by the hoisters, but that the most troublesome of the obstructions be removed first, and the others afterwards, as the hoisters will work back and forth over the whole river.

COMMERCIAL STATISTICS.

The commerce on the river during the past year has remained about the same as it was for the fiscal year ending June 30, 1885, except that the shipment of cotton increased by 4,543 bales this year, making a total of 13,400 against 8,857 bales last year. The freight has been transported by the usual number of steamers to Cheraw, and sailing vessels to Smith's Mill. There is, however, yearly quite a considerable quantity of freight carried by small boats, pole flats, or rafts, of which no account can be obtained. The traffic on this river will increase much more rapidly as soon as it is cleared of obstructions to Cheraw.

The work already accomplished seems to have benefited trade.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. W. H. BIXBY,
Corps of Engineers, U. S. A.

Commercial statistics for improving Great Pee Dee River, South Carolina, for the fiscal year ending June 30, 1886, furnished by the steamboat agents and other reliable business men.

Articles.	Quantity.	Value.
EXPORTS.		
Cotton ... bales..	26,600	$1,197,000
Naval stores ... barrels..	53,000	477,000
Crude turpentine ... do....	1,500	37,500
Rough rice ... bushels..	78,000	97,500
Lumber ... feet..	1,800,000	36,000
Shingles ... number..	4,000,000	40,000
Ton timber ... sticks..	15,000	45,000
IMPORTS.		
General merchandise ... tons..	10,000	500,000

Total value exports and imports, $2,430,000.

The commerce has been carried on by the usual number of steamers and sailing vessels as reported last year. The removal of many troublesome obstructions by the United States Government, and the water continuing higher for a long erperiod, permitted the boats to run with more regularity than for some years past.

L 10.

IMPROVEMENT OF WACCEMAW RIVER, SOUTH CAROLINA.

The Waccemaw River, emptying into Winyaw Bay at Georgetow C., has a total length of about 244 miles and a drainage area of 1 square miles of rich agricultural lands. This river, prior to gov mental improvement in 1880, was navigable for 12-foot-draught boa all stages of water from Georgetown, Winyaw Bay, 26 miles to Creek, and at high water, 4 miles further to Buck's Lower Mills; th for 7-foot draught boats at high water 36 miles further to Conwaybo thence it possessed an obstructed channel for 3-foot-draught boat ordinary water 124 miles to Reeve's Ferry, the present head of st navigation; thence an obstructed channel with 3-foot depth at h water for 54 miles to Lake Waccemaw, which is 244 miles distant fi Georgetown. The commerce of this river is estimated to have then b about $400,000 of transported goods per year.

The original project of 1880, as continued to date, proposed for $29, to secure a channel 12 feet deep at all stages of water, with 80-feet b tom width, from the mouth of the river 66 miles upward to Conwaybo and afterwards a cleared channel 178 miles further to Lake Waccem This estimate was required to be made hastily, inexpensively, and d ing a high-water stage in the river. Its insufficiency became so evid that in 1883 $54,000 was recommended to do work originally estima at $10,000; and later 1,000 logs, trees, and snags have been remove a single year from a channel bed supposed in 1880 to have been free fr such obstructions. The aggregate amount appropriated for this proj up to June 30, 1886, is $35,400. During the fiscal year of 1885 care surveys were made to determine the condition of all shoals where jett had been formerly constructed or started, and also of all shoals and sh bends where improvement appeared specially desirable. At all pla where jetties had been completed they appear to have done good, as boats experience less trouble to-day in passing these localities, but the want of adequate funds and other reasons half of these jetties w left unfinished, and the other half were only imperfectly and hurrie finished. The present maps are sufficient for the construction of care projects everywhere, and the required depth is now easily obtainabl the necessary funds be appropriated therefor. Besides this, the ri was personally examined several times in 1884-'85 from Conway Georgetown, and once in 1886 over its entire length from Lake W cemaw to Georgetown. This latter inspection revealed the agricultu richness of the river basin, its urgent need for transportation faciliti and the worthiness of the improvement.

The present estimate (that of 1885), $138,400, for the final cost of t work is based upon these later developments.

Thirty-five thousand three hundred sixty-seven dollars and sixt cents have been spent in all upon this improvement up to June 30, 18 giving a thoroughly cleared channel, with 100 feet least width and feet least depth at high water, as far as Conwayboro'. The comme upon this portion of the river has been thereby increased to ab $1,300,000 per year, showing that each dollar spent on this impro ment has been accompanied by a development of about $25 of ann commerce.

The river above Reeve's Ferry is crossed by three county bridges wi out draws. When needed the draws will undoubtedly be put in by county authorities.

The special work of the year is as follows: Expenditures, $3.35.

Owing to its variable features and the difficulty of properly specifying it beforehand and inspecting it afterwards, the work was allowably done by hired labor and the purchase of materials in open market.

In March, 1886, a careful and personal inspection was made of the entire river from its head in Lake Waccemaw to its mouth at Georgetown.

Other than this and office-work, and the care of the Government property, nothing was done, for the want of funds.

The general charge of the work has been under the immediate supervision of Assistant Engineer Reid Whitford. His full report, including a brief history of past work on this improvement, is herewith appended.

Recommendations for further work are as follows:

That this improvement be completed in accordance with the present approved and adopted project so far as at present to secure a channel 12 feet deep at mean low water, with 80 feet bottom width, from the mouth of the river 41 miles up to Bucksville; and thence a channel 10 feet deep at mean low water, with 80 feet bottom width, 25 miles further to Conwayboro'; thence a thoroughly cleared 3-foot navigation 124 miles farther, to Reeve's Ferry, throughout the entire year; and thence a thoroughly cleared natural channel, 54 miles further, to Lake Waccemaw; at a total expense of $103,000 in addition to the $32.84 available June 30, 1886, this amount to be appropriated in two yearly installments of $63,000 and $40,000 respectively. Smaller yearly appropriations, involving the alternate disorganization and reorganization of working parties, damage to unfinished work, extra superintendence, and deterioration of plant, will increase the cost of the work by from $1,000 to $4,000 per appropriation. Further improvement, in accord with the original project so as to secure a 12-foot navigation at all stages of water from Bucksville 25 miles to Conwayboro', is not recommended at present.

After this improvement is finished its proper maintenance may cost from $1,000 to $4,000 per year.

This improvement as regards order and cost of work should be carried on approximately as follows:

Forty-five thousand dollars to secure a cleared natural channel for steam navigation from Conwayboro' 24 miles upward to Reeve's Ferry, by removing all sunken logs and snags, and by cutting down and pulling back from caving banks the trees that would otherwise soon fall into the river.

Eighteen thousand dollars to secure a 12-foot navigation at high water, from the mouth of the river 41 miles upward to Bucksville, and a similar 10 foot navigation thence 25 miles upward to Conwayboro', by dredging and jettying.

Forty thousand dollars to secure a deepened navigation at all stages of tide, and water of 12 feet depth from the mouth to Bucksville, 10 feet depth thence to Conway, and 3 feet depth to Reeve's Ferry, and to give a cleared and natural channel thence to Lake Waccemaw.

This river is in the collection district of Georgetown, S. C.

Money statement.

July 1, 1885, amount available	$36 19
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	3 35
July 1, 1886, amount available	32 84
Amount appropriated by act approved August 5, 1886	15,000 00
Amount available for fiscal year ending June 30, 1887	15,032 84

Amount (estimated) required for completion of existing project........ $92
Amount that can be profitably expended in fiscal year ending June 30, 1888 60
Submitted in compliance with requirements of section 2 of river and harbor acts of 1886 and 1887.

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE
Georgetown, S. C., June 15,

CAPTAIN: I have the honor to report as follows on the improvement of the
maw River, South Carolina, to date of present fiscal year:

GENERAL FEATURES.

This river has its source in Waccemaw Lake, North Carolina, and, after flo
a southwesterly direction approximately parallel to and not far from the se
empties its waters into Winyaw Bay, at Georgetown, S. C. The lake is a
fresh water about 3 miles wide and 5 miles long, with probable average de
feet,* situated on the line of the Wilmington, Columbia and Augusta Railroa
25 miles from Wilmington, N. C. The total length of the river is possibly 24
and the distance from head to mouth by a straight line would probably be 80

During low stage of the river the influence of the lunar tides is felt probabl
up as 105 miles above Georgetown, which goes to prove that even the total fa
river must of necessity be very little.

At the flush-water periods, however, there is a constant fluvial current, for t
part though there may be a slight swell of the flood for some distance up th

There is no trouble about a 90-foot navigation of 8-feet depth at present to
ville, 40.5 miles above Georgetown at any stage of the water, and 6 feet fr
place to Conway, the principal town on the river 25 miles further up.

Above Conway the depth is less, though steamers drawing from 3 to 4 fee
ally run to a point at least 40 miles above that town, at possibly the lowest s
the river.

There is very little current on the Lower Waccemaw, but a greater velocit
upper portion of the river is found.

This stream flows through a cypress and juniper timbered land, which im
its waters a dark hue, but the water is said to be very pure and healthy.

The soil along the river is well adapted to the production of cotton, corn, p
rice, and various fruits. The lands generally are well and richly timbere
thought that there is no river in this State better suited to free, safe, and easy
tion than this. The Waccemaw may at some future day form a link in the
the proposed "Inland Water Route" along the Atlantic coast. Capt. Ch
Phillips refers to the possibility of this in a report of his to the Chief of Engi
1880 concerning this river, and adds that this same thing was mentioned
years previous to that time by Lieut. Col. James Kearney, Topographical E

HISTORY OF THE IMPROVEMENT OF THE WACCEMAW.

1778.† An act of the South Carolina legislature providing for the improve
the river from the North Carolina line to Holder's Bluff, the work to be don
male inhabitants of the country along the river, each of whom was to serve
way twelve days in the year.

1783.† An act of the same legislature provided for the improvement betwee
and in the same manner as above mentioned.

1805.† An act of the same legislature was found which appointed a Board
missioners whose duty it was to ascertain, by examination, the cost of the i
ment of the river from the mouth of Bull Creek to the North Carolina State

1879. March 3 an act was passed by the United States Congress providin
examination of the river.

The examination was made the following November under the direction
Charles B. Phillips, Corps of Engineers, United States Army. It was estima
the total cost of improving the river would be $29,370, and Captain Phillip
mended that this amount be expended in carrying out a project which conte

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* See Annual Report of the Chief of Engineers for 1884, page 1057.

† See back acts of South Carolina legislature.

ving obstructions, such as sunken logs, snags, overhanging trees, &c., from the
. both above and below Conway.[*]

0-'81. An act of Congress June 14, 1880, appropriated $15,000 for this work.[*]
Heth, assistant engineer, was placed in local charge of this work in the autumn
0. Capt. James Mercur, Corps of Engineers, United States Army, assumed con-
f the improvement upon the death of Captain Phillips, June 14, 1881.

February of this year the project was modified and improved to embrace the con-
tion of jetties and dikes at twelve points below Conway. This was done because-
h advertised for the usual length of time, there were no bids received for dredg'
nd aside from this it was thought that any extra depth gained by such means
d only be temporary, unless the water-ways were contracted by jetties, and the
nts over the shoals thus accelerated.[†]

act of March 3, 1881, appropriated $10,000 for this work.

work of building jetties was begun in March, 1881, at the Needles Eye Shoal,
o the end of the following June the piles had been driven on two other shoals,
at Bed and Green Landing. Some work was also done before the end of the
year of 1881 towards deepening Needles Eye Shoal by the scouring action of a
oat's propeller screw. The boat employed for this purpose was properly moored
omplish the same.[†]

1-'82. An act of August 2 appropriated $4,400 more for the improvement. Dur-
e fiscal year of 1881-'82 jettying was done on six additional shoals, and more
was done at Needles Eye and Oat Bed shoals.[‡]

river was further improved this year by the removal of sunken logs and over-
ng trees.

rations ceased for the season 31st of May, 1882.[‡]

-'83. Captain Mercur, finding the amount of the original estimate totally in-
ate to complete the improvement, recommended an expenditure of $25,228 more
direction.[§]

k was resumed March 29, 1883, and owing to the small amount of the appro-
n then remaining available it was determined to apply this to the removal of
logs, &c., from the bed of the river, and overhanging trees from its banks.
ork was being carried on between Conway and Cox's Shoal at the end of the
ear 1883.[‖]

-'84. Captain Mercur examined the Waccamaw River between Lake Wacce-
North Carolina, and Conway, in the year 1883.[¶]

k of removing obstructions was carried on between Conway and Needles Eye
uring fiscal year, and 2,871 trees which overhung the channel were removed,
few logs and snags taken out of same.[**]

-'85. Captain Mercur was relieved by Captain Hinman, Corps of Engineers, in
. 1884.

Whitford, assistant engineer, was placed in local charge of the work in May,
ice H. Heth, assistant engineer, resigned. An act of July 5, 1884, appropri-
,000 more for carrying on the improvement.[**]

ain Hinman was relieved by Captain Bixby, Corps of Engineers, United States
in August, 1884. During the fall and winter of 1884 and 1885 careful surveys
ade of all the shoals and most of the proposed cut-offs below Conway, and water-
and bench-marks established at the same places, securing the low-water level.
e surveys were for the purpose of basing thereon reliable estimates, looking to
work connected therewith.

-'85. Under the existing project operations were resumed at the town of Con-
September 22, 1884, and continued till 7th of following April, when work was
d because of exhaustion of funds. The improvement this time consisted en-
n the removal of logs and snags from the bed of the river and the trimming
f overhanging growth from the banks, all below Conway. In this way for the
7 sunken logs, 100 stumps, 35 large trees with roots, 17 cords of small snags,
ls of rosin, 3 sticks of timber, 1 large flat-boat, and 1 small schooner were re-
from the channel, and 591 large trees with roots, 1,061 small trees, the branches
other trees, 99 protruding stumps, and 14,550 linear feet of brush were cleared
e banks of the river where they overhung and impeded navigation.

les the above, 15 cords of felled trees and brush and 131 cubic yards of earth
ots were removed from Little Needles Eye Cut-off, and repairs begun at Oat
oal Jetty.

Annual Report of Chief of Engineers for 1880, pages 848 and 849.
Annual Report of Chief of Engineers for 1881, pages 1030 and 1031.
Annual Report of Chief of Engineers for 1882, pages 1108 and 1109.
Annual Report of Chief of Engineers for 1883, page 868.
Annual Report of Chief of Engineers for 1883, page 869.
Annual Report of Chief of Engineers for 1884, page 1056.
Annual Report of Chief of Engineers for 1884, page 1048.

The foregoing work thoroughly cleared the Waccemaw of obstructions belo way, so far as a careful examination and diligent search indicated.*

Captain Bixby has revised the estimate for the improvement of this river, recommended that a further total of $103,000 be expended in this way, and t work be extended above Conway, so as to open up the very considerable comm that portion of the river.*

1885–'86. There has been no work of any kind carried on since the end of tl year of 1885. It will be seen from the above that work has been either actua ried on or proposed at intervals for the past 108 years.

It is generally thought wherever the jetties have been completed they ha the means of increasing the depth of water at such points.

The following appropriations have been made to date hereof:

June 14, 1880..
March 3, 1881..
August 2, 1882 ....
July 5, 1884..

Total ....

RECOMMENDATIONS FOR NEXT SEASON'S WORK.

It is respectfully recommended that the improvement of the river be carrie Conway, and that the logs and snags be removed from the channel during lo and the overhanging growth trimmed and cut away at high water.

It is further recommended that no attempt be made to thoroughly clear tl of obstructions at the time of the first working over, but the most troubleso dangerous impediments to navigation be removed first and others afterward river is worked over back and forth.

It is also recommended that during the flush-water period, when work ca done to advantage on the Upper Waccemaw, the Little Needles Eye Cut-off pleted, Big Needles Eye Cut-off made, and such repairs to and completion of isting jetties be prosecuted as may be deemed necessary. Owing to the diffi properly classifying the work upon this river it is respectfully suggested th done by hired labor and machinery, which method of work it is thought will economical and advantageous to the Government.

COMMERCIAL STATISTICS.

As far as has been ascertained there has been very little, if any, change commerce on this river since the date of my last annual report. It is proba traffic has somewhat increased upon the Upper Waccemaw.

The commerce has been carried on by the usual number of sailing vessels, st flat-boats, &c.

The clearing out of the Upper Waccemaw will give an isolated country an and thereby will at once increase considerably the amount of trade on the ri

Very respectfully, your obedient servant,

REID WHIT

Capt. W. H. BIXBY,
Corps of Engineers, U. S. A.

Commercial statistics for improving Waccemaw River, South Carolina, for the fi ending June 30, 1886, furnished by Mr. J. I. Hazard, of Georgetown.

Articles.	Quantity.	A
EXPORTS.		
Lumber .... feet..	2,773,961	
Shingles .... number..	2,260,700	
Timber .... feet..	350,000	
Rosin .... barrels..	53,500	
Spirits turpentine .... do....	12,250	
Crude turpentine .... do....	10,160	
Rough rice .... bushels..	100,000	
Clean rice .... barrels..	20,241	
Cotton .... bales..	5,000	
Miscellaneous	....	
IMPORTS.		
General merchandise .... tons..	5,000	
Total value exports and imports	....	1,

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* See Annual Report of Chief of Engineers for 1885, page 1105.

REMARKS.

ommerce has been carried on by about the same number of steamers and sail-
els as reported last year, with the addition of an extra propeller steamer put
river during the year.
boat carries the United States mail, freight, and passengers, and is an entire
n. There is also in course of construction a small steamer on the upper river to
l above Conway.

L 11.

MPROVEMENT OF GEORGETOWN HARBOR, SOUTH CAROLINA.

rgetown is situated at the head of Winyaw Bay, and at the con
e of the Sampit, Great Pee Dee, and Waccemaw rivers (the lat
ving conjointly a drainage area of 18,040 square miles), and is the
al harbor and sea-port for all commerce passing to and from these
and their tributaries. Georgetown is also a railroad terminus.

harbor, prior to governmental improvement in 1880, had an ex-
t well-protected anchorage of at least 1 mile in length, 150 feet
, and 15 feet depth. A bar of about 2,850 feet length and with
9 feet depth of water was the only obstacle to an otherwise good
t navigation from Georgetown 13 miles to the ocean. The com-
of this harbor is estimated to have then been about $2,000,000 of
orted goods per year.

original project of 1881, as continued to date, proposed for
00 to secure a dredged channel of 200 feet bottom width and 12
ow-water depth entirely through this bar. This estimate was based
e supposition that the bar was composed only of sand and mud. In-
ate appropriations delayed all work until 1884, and when actual
was commenced it was found that the sand and mud was a mere
surface-covering to an old cypress swamp, involving the further
val of about 600 enormous stumps. The aggregate amount ap-
riated upon this project, up to the 30th June, 1886, is $12,000. The
ent estimate (that of 1885), $39,000 for the final cost of the work,
ased upon these later developments.

Eleven thousand nine hundred and eighty-six dollars and four cents
e been expended in all up to June 30, 1886, giving a through cut en-
ly across the bar with 12 feet low-water depth, and with a variable
th of from 40 to 80 feet. The commerce of the harbor is now about
500,000 per year, showing a total increase of $1,500,000 per year
ve that of 1880.

The special work of the year is as follows: Expenditures, $3,552.91.

The amount appropriated up to July, 1884, was too small for eco-
mical work, but work was then commenced because improvement was
much needed that small immediate results were regarded as more
able than larger but delayed possible results.

Under an existing contract with Mr. Cephas Gilbert, of Georgetown,
rk was continued from the 30th June to 13th August, 1885, when it
d to stop for want of further funds. During this time 2,684 cubic
rds of sand, mud, and small roots, 66 large stumps, and 1 log were
moved from the channel-bed; completing a cut entirely through the
r from Sampit River to Winyaw Bay, 2,640 feet long, at least 12 feet
p everywhere at low water, and 80 feet wide over 860 feet length,
feet wide over 720 feet length, and 40 feet wide over the remaining
00 feet length.

Other than this, and office work, and the care of the Gover
property, nothing has been done for want of funds. This wo
been carried on with great vigor and thoroughness under the in
ate supervision of Assistant Engineer Reid Whitford. His full
including a brief history of past work upon this improvement, is
with appended.

Recommendations for future work are as follows: That the abo
provement be completed in accordance with the present approv
adopted project, so as to secure a channel of 12 feet depth at me
water, and of about 200 feet bottom width, entirely through th
at a total expense of $27,000 in addition to the $13.96 availabl
June, 1886; this amount to be appropriated in two yearly instal
of $20,000 and $7,000, respectively. Smaller yearly appropriati
volving the alternate disorganization and reorganization of w
parties, damage to unfinished work, extra superintendence, and
oration of plant will increase the cost of the work by about $2,0
appropriation. Further improvement is desirable in order to co
this channel by a similar easy, well marked, and well defined c
entirely through the upper portion of Winyaw Bay. With this
in view a survey of the entrance to Georgetown Harbor, through
yaw Bay, South Carolina, is desirable, and is recommended as an
sion of the Georgetown Harbor improvement.

The channel once thoroughly opened will probably be perm
By this improvement ocean vessels of 12 feet draught, after once
ing the Winyaw Bay Bar, can proceed without further delay 15
further to their anchorage at Georgetown.

This improvement, as regards cost and order of work, should
ried on as follows:

The present channel should be first widened throughout to
width, next to 80 feet width, and so on, each successive addition
channel width being carried through the entire length of cut.
moval of stumps must accompany or follow immediately the rem
mud and sand. Immediate improvement is so necessary that a
propriation, however small, should be immediately utilized.

Georgetown is a port of entry.

Money statement.

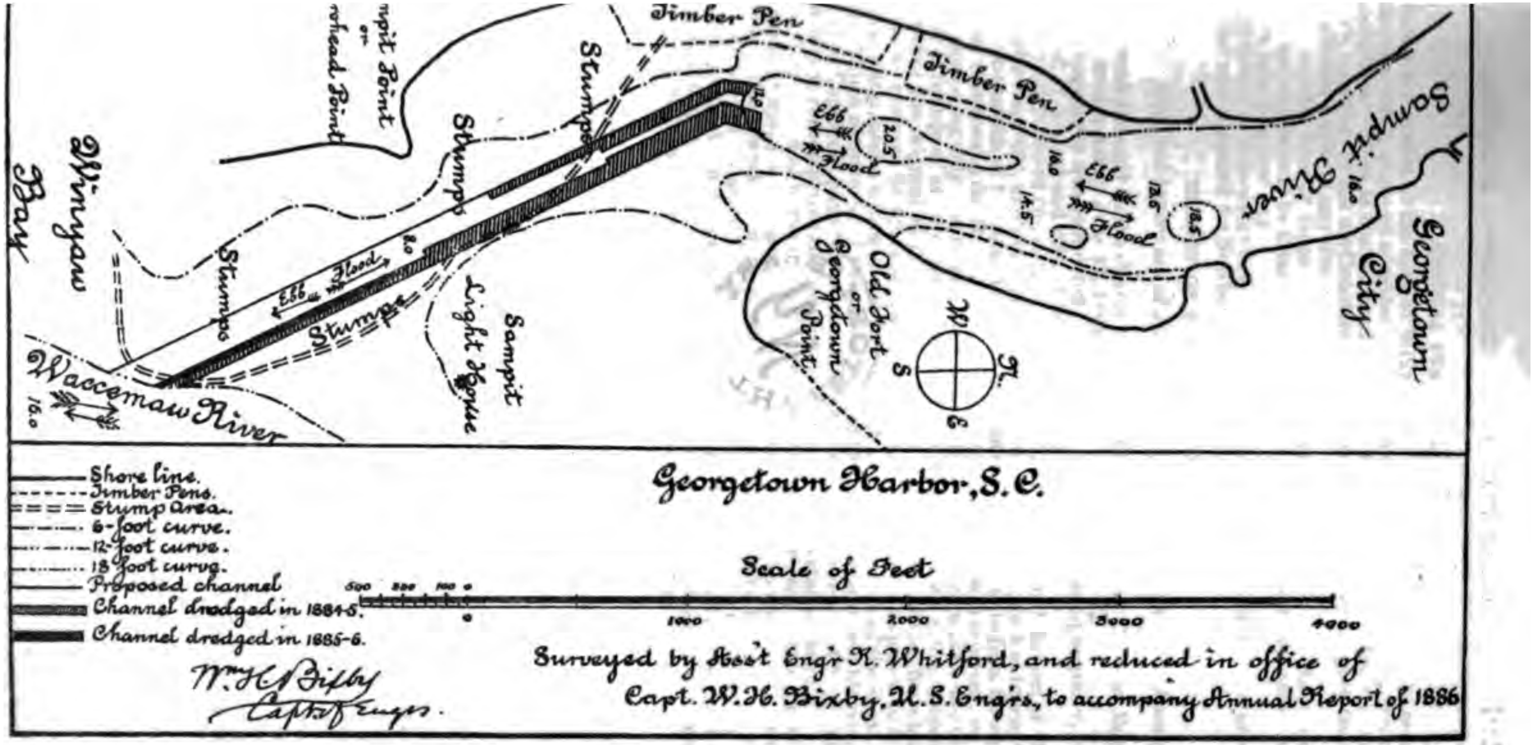
July 1, 1885, amount available		$3
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$3,550 19	
July 1, 1886, outstanding liabilities	2 00	
		3
July 1, 1886, amount available		
Amount appropriated by act approved August 5, 1886		5
Amount available for fiscal year ending June 30, 1887		5
Amount (estimated) required for completion of existing project		24
Amount that can be profitably expended in fiscal year ending June 30, 1888		24

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1967.

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFIC
Georgetown, S. C., February 26,

CAPTAIN: I have the honor to make the following annual report concern
improvement of Georgetown Harbor, S. C., to date of present fiscal year.



Georgetown Harbor, S. C.

Surveyed by Ass't Eng'r R. Whitford, and reduced in office of Capt. W. H. Bixby, U. S. Eng'rs, to accompany Annual Report of 1886

Wm H Bixby
Capt of Engrs.

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GENERAL FEATURES.

is harbor is situated at the head of Winyaw Bay, about 13 miles from the ocean
t Georgetown, a place of considerable commercial importance, having nearly
inhabitants. There is one railroad here on which is run daily a train to and
Lane's, a station on the northeastern railroad, giving the town very good facili-
r mails and travel in any direction.

re are regular lines of large first-class schooners to New York and Baltimore,
ll as lines of steamers to Charleston, S. C., and up the various rivers emptying
waters into Winyaw Bay.

cultivation of tide-water rice is largely carried on in this vicinity, and much
s milled and prepared for Northern markets in Georgetown.

HISTORY OF PAST IMPROVEMENT.

-'80. The river and harbor act of June 14, 1880, provided for a survey of George-
Harbor.

s work was assigned to the charge of Capt. Charles B. Phillips, Corps of Engi-
, United States Army, June 17, 1880.

-'81. This survey was completed by Charles W. Forster, assistant engineer, be-
the 19th of August and 26th of September this same year.

report that followed (for details see pages 1036 and 1037 Annual Report of the
of Engineers, 1881), explained the existence of a shoal about 2,850 feet in length
across the mouth of the Sampit River and from one-half to 1 mile from George-
. Upon this shoal a depth of 9 feet, at ordinary low water, was reported, with
ttom consisting only of sand and sand mixed with mud. There was no mention
of the existence of stumps, and nothing of the kind was taken into considera-
n forming the original estimate, amounting to a total of $14,151.94, for which
was to be removed 64,327 cubic yards of material, furnishing a depth of 12 feet
n low water, and a width of 200 feet through the entire length of the shoal.
tain Phillips recommended the expenditure of the above amount (see his report
Chief of Engineers, page 1036, Annual Report Chief of Engineers for 1881). The
ed project contemplated the completion of the project as stated above.

-'82. The river and harbor act of August 2, 1882, appropriated $7,000 for this
rement. Capt. James Mercur, Corps of Engineers, United States Army, who as-
charge of this work upon the death of Captain Phillips, June 14, 1881, recom-
d that operations should not be commenced (see his report to the Chief of
eers, page 872 Annual Report Chief of Engineers for 1883) because the amount
ought to be too small to accomplish much good, and inasmuch as the construc-
dikes might be necessary to prevent the dredged channel from filling.

-'84. The river and harbor act of July 5, 1884, appropriated $5,000 for this
making a total of $12,000 available.

. F. A. Hinman, Corps of Engineers, United States Army, who succeeded Cap-
ercur in March, 1884, recommended (see his report to the Chief of Engineers
52, Annual Report Chief of Engineers for 1884) that the work be commenced.
o stated that dikes would probably be required, and in addition possible
cal dredging to keep the channel open.

-'85. Captain Hinman was succeeded by Capt. W. H. Bixby, Corps of Engi-
United States Army, in the charge of this work in August, 1884. Having been
ised for the usual length of time, in the autumn of this year the contract was
d to Cephas Gilbert, of Georgetown, S. C., he being the lowest bidder.

re preparations were begun by him with a dipper-dredge on the 8th of De-
of the same year. At the beginning large cypress stumps were encountered
rooted in the bottom, and upon examination the entire lower part of the shoal
redged was found thickly covered with stumps. This, together with very un-
ble weather, greatly retarded the progress of the work, and the stumps im-
y increased the cost of the same over the original estimate. To June 30 of
ar there had been dredged and removed from the shoal a total of 20,924 cubic
of material, 3 logs, and 75 stumps of trees over 1 foot in diameter. At this
ere had been completed one cut 20 feet wide and 12 feet at mean low water
h the entire shoal, and several other cuts aggregating a total width of about
, and depth as given above had been finished about half way through the bar.

WORK OF PAST YEAR.

-'86. After June 30, 1885, dredging was continued until another cut 20 feet wide
feet deep at low tide was completed through the total length of the bar, thus
g the 40 feet width for a distance of 2,640 feet down to the 12-foot curve in
w Bay, and thereby securing a uniform width of 40 feet through the entire bar.
this last cut there were removed 2,684 cubic yards of material, 1 log and 66
s of trees over 1 foot in diameter. As the dredging was extended toward
t Point there was found an increased number of stumps over those removed
he first cut through. It appears that this may be expected to be the case as
annel is widened. After finishing the second cut through August, 1885, on the

[illegible] of funds. Sheet A,
[illegible] recommended that the ch
[illegible] at each cut be carried entirely
[illegible] on any other portion of the sh
[illegible] most serviceable.
[illegible] report to the Chief of Engineers, i
[illegible] and 1115, 1885), the continuati
[illegible] and the further expenditure o
[illegible] 15).

[illegible] STATISTICS.

[illegible] commerce of the harbor, so far as I a
[illegible] servant,

REID WHITFO
Assistant E

[illegible] harbor at Georgetown, S. C., for the fiscal y
[illegible] by Mr. J. I. Hazard, of Georgetown.

[illegible]	Quantity.	
[illegible]		
feet..	5,535,376	
number..	5,811,508	
barrels..	143,496	
do....	27,503	
bales..	31,079	1
barrels..	28,058	
do....	570	
bales..	89	
do....	25	
barrels..	6	
number..	19,655	
barrels..	147	
cases..	1	
IMPORTS.		
tons..	30,000	1,
[illegible] and imports	....	3,

REMARKS.

[illegible] been carried on by about the same number of sailing ve
[illegible] last year, with the addition of one steamer, together
[illegible] of several square-rigged vessels to and from foreign

---

L 12.

[illegible] OF THE SANTEE RIVER, SOUTH CAROLINA

[illegible] River, formed by the Congaree and Wateree riv
[illegible] the Atlantic Ocean just south of Winyaw Bay, h
[illegible] headwaters in the mountains a total length of ab
[illegible] drainage area of 15,414 square miles. It was f
[illegible] 4 foot draught boats from the sea up to Columbia
[illegible] Camden on the Wateree.

[illegible] date of the commencement of governmental impro
[illegible] was considerably obstructed and blocked at al
[illegible] by sunken logs, snags, and floating timber. Its bar e
[illegible] narrow, crooked, and shifting, with only about 4 feet depth

w tide, and so situated as to be very difficult and expensive to im-ve. Four steamers and a few small vessels were then running upon tions of the river. Its commerce is estimated to have then been t $600,000, and to now be about $1,400,000 of transported goods r year.

The original project of 1880 proposed for $104,000 to provide the river h a good outlet through Mosquito Creek to Winyaw Bay, by deep-ing and straightening this creek to 50 feet width and 7 feet depth, t an expense of $74,000; and to secure a safe and unobstructed 7-t navigation in the river itself from its mouth 154 miles upward to right's Bluff; and thence a similar 5-foot navigation 30 miles further its head in the Congaree and Wateree rivers at an expense of $30,000. is estimate was based upon a hasty and inexpensive survey, which pposed very easy and cheap dredging and no need of revetment at squito Creek, and comparatively few obstructions in Santee River. bsequent work and examinations developed numerous cypress stumps d much hard sand to be removed, and much revetment to be put in Mosquito Creek, and showed the river obstructions estimated for re far below the number per mile actually taken out from the similar ighboring rivers. In both cases the estimates should have been more n doubled to agree with facts later developed.

The aggregate amount appropriated upon this project up to June 30, 6, is $57,000. The present estimates, based on the later develop-nts, are as follows:

r Mosquito Creek Canal:		
06,000 cubic yards dredging, at 33⅓ cents		$202,000
1,440 stumps, at $30 each		43,200
Drainage and dike protection against the ocean		5,600
6,000 linear feet revetment, at $3		18,000
Drawbridge (as constructed)		2,500
		271,300
r river proper:		
184 miles, at $300 per mile	$55,200	
Dredging and rock excavations	15,000	
Diking	5,000	
		75,200
		346,500

The appropriation of 1881 and since provided only for work upon the utlet of the river through Mosquito Creek to Winyaw Bay, and the pproved project of 1881 for this expenditure, as continued to date, pro-osed to secure to the river a straightened canalized outlet through osquito Creek, 7 miles long, 30 feet wide, and 6 feet deep at mean low ater, and to construct one draw-bridge over this creek. This work as estimated at $43,000, but being estimated on the same basis as the revious project, this amount was not half large enough. The present stimate, $144,000, based on the later developments, is as follows:

3,000 cubic yards dredging and 90 stumps (caves and deepening canal to 6 feet)	$13,700
4,000 cubic yards dredging and 90 stumps (deepening of creek)	10,700
00,000 cubic yards dredging and 20 stumps (extension of canal)	40,000
,000 linear feet revetment, at $3	18,000
rainage and dike protection against the ocean	5,600
	88,000
lready spent	55,346
Total	143,346

If found necessary a tide-lock must be added at a further cost of perhaps $5,000.

13th the work was suspended ow
sent, shows the work done and th
For the next season's work it
widened by working from east
the shoal before other dredging
dredged channel will thus be ren
Captain Bixby recommended
Report of Chief of Engineer
work, under the present appr
including the funds then avail

There is no change in the
since the date of my last
Very respectfully, you

Capt. Wm. H. Bixby,
Corps of Engineers.

Commercial statistics for
June 30, 1

Lumber
Shingles
Rosin
Spirits turpentine
Cotton
Rice
Tar
Wool
Hides
Wax
Cross-ties
Crude turpentine
Furs
General merchan
Total value

The comm
steamers
arrival of

The
comp
the
miles
hav
Co

and forty-six dollars and th
all upon this improvement up to
cubic yards of hard sand and mud,
thereby cutting 15,610 linear feet of
from Mosquito Creek toward Winyaw
of the whole improvement, and in buil
in accordance with the provisions of
canal. No improvement of comm
any to be expected therefrom until
completed.
as follows:

at the commencement of the fiscal
work, but improvement was so m
actual results were regarded as
possible ones.
and the difficulty of properly spec
it afterwards, the work was allowa
purchase of materials in open market.
1885, and the end of November a dre
Georgetown, S. C., removed 13,354 cubic ya
logs and 9 stumps from 1,835 linear
removed 2,073 cubic yards of caves and sli
canal, thus opening the canal at both e
Mosquito Creek.
with the creek were rounded off to facili
further work of dredging was stopped for w
canal is in general 30 feet wide, and 5 feet d
three points it is narrowed by caves
width and 3 feet depth.
present narrow, crooked, and shallow
opened in November it would allow only
length, 18 feet width, 3 feet draught, to pass
Winyaw Bay to the Santee River.
a rolling draw-bridge of 40 feet clear s
including approaches), allowing the passag
13 feet high, was built at the existing road
than $2,500. This draw-bridge presents a
easily maneuvered by one man, and gives g
public. This work was done by hired
ent failed to secure reasonable bids.
surveys were made of the canal and adja
of the lagoons and marsh between the ca
to determining the best connection betw
the best method of draining the lagoons
the shortening of the present located cr
of the present outlet of Lagoon Creek into
establishment of a catch-sand fence between
and the drainage of the lagoons along their
Little Minim Creek and the Santee River. I
constructions will be given prior to commenc

at a time of excessive high tides and heavy wi
a time when the ocean salt water might h
the low beach into the Lagoons Canal, the ca
expensive dike—first, as a safeguard against a ba

gh improbable, future injury to the rice interests during
incomplete condition of the canal and the present rice-grow-
n. and, second, as a means of completing desirable observa-
o the motion and quality of the water in the canal with refer-
he merits or necessity of a future flood-gate or tide-lock in the

ries of inspections and special examinations were commenced in
ber, 1885, while the canal was open, in order to determine whether
ening of the canal had damaged or would damage the rice inter-
the neighborhood by the introduction of salt or impure water.
report of the result of these examinations was rendered on the
ebruary, 1886 (since published in House Ex. Doc. No. 114, Forty-
Congress, first session; copy inclosed). From the 26th March,
mmencement of the rice-planting season, up to the 30th June, 1886
1st of March accidentally omitted), inspections of the canal have
ade daily and numerous samples of water at various points have
ollected and bottled. These inspections commenced while the
was open and continued after the canal was closed, and they have
upplemented by several special inspections, some made by a rice
r of long experience, some by the assistant engineer, some by
, one of the latter having extended over the whole length of the
t a moment when all conditions were most unfavorable to the
ss of the water in the canal, and on a day and even hour when
l complaints were being made unknown to me at the time. In
st of May and through June heavy freshets in the Pee Dee
antee rivers flooded the rice-fields with fresh water. All the
ce collected from these examinations and inspections and from
er reliable sources tends to show that Mosquito Creek has
o salter and no more impure since the opening of the Government
than it was before such opening, and they show that while the
ment Canal was open (and since) some of the salt, bad, or impure
n the Government Canal has come from the rice-planters' canals
e rest of it has come from the upper tidal basins of the creek it-
d none of it has come through the Government Canal; that by
of the canal there has been no flow of salt water into Mosquito
nor any injury to the rice interests; and that the preponderance
on of water in the canal has been from the Santee River towards
w Bay, this being the direction which will benefit, instead of in-
the rice interests.

commencement of this canal in 1881–'82 and its opening in 1885
een bitterly opposed by Mr. R. I'on Lowndes, a rice planter of
ito Creek. In 1881–'82, after a delay of four months and a full
gation by the War Department, his objections were found insuf-
and work was ordered to be resumed. (See action of Secre-
War, dated 3d March, 1882, on letter of Engineer Department,
ighteen inclosures.) In December, 1885, another vigorous at-
was made to delay work by complaints that the opening of the
had damaged the rice interests, and that the canal must be
or furnished with a tide-lock. My full report of 25th February,
howed that past damage was imaginary, and that future dam-
hen probable, would be prevented by simple means available
Engineer Department, as had been previously stated to Mr.
es.

ther attack was later made by Mr. R. I'on Lowndes' own peti-
Congress, dated 6th February, 1886, accompanied by the peti-
ated 1st February, 1886, of sixty-two other persons claiming to

Fifty-fiv
seven cent
30, 1886, i
518 cypress
30 feet wid
in making
a draw b
cession of
has yet b
canal sho
The spe
Experi
The an
was too
needed f
valuable
Owing
ing it bef
done by ha
Betwe
owned b
of mud an
of new ca
from 567
to 3 feet
The ju
the entra
of availab
at low wa
slides to
The cree
that when
and boats
tirely thr
Between
and 235 fe
wagons 10 f
crossing at
appearance.
satisfaction
bor, becaus
In May
river at its
and ocean,
the canal
marsh. Th
entrances,
Government
lagoons and
mer drainag
reasons for
actual work
On the 1
from the o
terribly was
was closed b

ultivation on Mosquito Creek, and repeatin
made by Mr. Lowndes. These petitions
March and 1st of May, shown to be withou
furthermore, several of the signers of th
came forward and made affidavit (see my
the time of signing the petition they were l
Mr. Lowndes; that the petition was not re
that they did not know the purport of said pet
that the rest of the sixty-two persons were
of Mr. Lowndes; and that they had never
the Mosquito Creek water resulting from
h the United States Canal. Considering
respondence connected with Mr. Lowndes'
ency of his reasons, the damage to the
neighborhood by these unnecessary delays,
ress of the work, the expense of otherwise
and examinations, the comparatively small v
rated for taxation, buildings included
of commencement of the canal, and the
ndes' petitions appear by affidavit to have b
norant of what they were signing, I recomm
plaints from Mr. R. Pon Lowndes be answe
past records.

The work of this improvement has been carr
thoroughness under the immediate supervis
Reid Whitford, whose report (including a b
this improvement) is appended.

future work are as follows:
be completed in accordance with the pres
project of 1881, so as to secure to the San
canalized outlet through Mosquito Creek 7 mi
feet deep at mean low water at a total expe
the $1,653.63 available 30th June, 1886, t
ated in two yearly installments of $48,000 a
also that this improvement be extended in
ed original project of 1880, so as to secure
foot navigation from the mouth of the Sant
o Wright's Bluff, and thence a similar 5-fo
ver to its head in the Congaree and Water
of $75,000, to be appropriated in two year
000 each. Smaller yearly appropriations, i
disorganization and reorganization of worki
ished work, extra superintendence, and dete
increase the cost of the work by from $2,000
It is estimated that this last recommend
ence (as already shown by past experience
ee River) increase the Santee River commerce
000 per year. Further improvement, so as
widths and depths of either canal or river, is not r
ce shall have shown a further immediate nec

ent is finished, its proper maintenance may c
per year.

more short cut-offs should be made across lo
k, and perhaps one located cut-off be chang
expense of obtaining the right of way for these c

, if anything, will be slight. It is therefore recommended that such
ll portion of the amount appropriated for the improvement of the
tee River, South Carolina, as is deemed advisable by the Secretary of
r, may be used for acquiring the right of way for the proposed proj-
the said right of way to be obtained by agreement with parties in-
sted, or in the event of failure to make a reasonable agreement, by
lemnation, as provided for by the laws of the State of South Caro-

is improvement, as regards cost and order of work, should be car-
on as follows:
ive thousand six hundred dollars for side-drainage and protection
he canal against the ocean, of which $4,000 for a drainage-ditch
ı the Lagoons into Little Minim Creek; $1,000 for a catch-sand
e to form a sand-dune at the rear of the ocean beach, and $600 for
ke across Lagoou Creek just above where it now enters the canal.
hirteen thousand seven hundred dollars for redredging caves and
s from the existing canal and deepening it everywhere to 6 feet
h.
n thousand seven hundred dollars for deepening Mosquito Creek,
een the canal and the Santee and the Winyaw entrances.
rty thousand dollars for extending the canal along its located line
uding four cut-offs).
ghteen thousand dollars for revetting the side of the canal where
ssary.

ı river and Mosquito Creek are in the collection district of Georgetown, S. C.

Money statement.

, 1885, amount available		$16,647 05
, 1886, amount expended during fiscal year, exclusive of ilities outstanding July 1, 1885	$14,557 33	
, 1886, outstanding liabilities	436 09	
		14,993 42
, 1886, amount available		1,653 63
ıt appropriated by act approved August 5, 1886		18,750 00
ɔt available for fiscal year ending June 30, 1887		20,403 63
ıunt (estimated) required for completion of existing project		150.000 00
ıunt that can be profitably expended in fiscal year ending June 30, 1888		93,000 00

mitted in compliance with requirements of section 2 of river and
ırbor acts of 1866 and 1867.

ıct *of proposals for building a rolling draw-bridge over Mosquito Creek, South Carolina, opened December 7, 1885, by Capt. W. H. Bixby, Corps of Engineers.*

Names and addresses.	Price.
. A. Ramsay Engineering Works, Baltimore, Md.	$1,900 for the superstructure only.
amuel W. Skinner, Wilmington, N. C	$4,467 for bridge, as per specifications, or $4,138 with creosoted piling in place of piling encased in cement and iron cylinders.
ing Iron and Bridge Manufacturing Company, Cleveland, Ohio.	$5,868 for an iron draw-bridge and approaches.

cted; price too high. Bridge built by hired labor and purchase of materials in open market at
cost of $2,316.12.

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFIC
Georgetown, S. C., June 30,

CAPTAIN: I have the honor to make the following report upon the improve
the Santee River to date of fiscal year now ending:

GENERAL FEATURES.

The Santee is formed by the Congaree and Wateree rivers uniting their wat
after flowing about 184 miles in a generally southerly direction, empties its wat
the Atlantic Ocean near Winyaw Bay Bar.

The river traverses a country noted for the number of virgin forests, yiel
excellent quality of cypress and other valuable timbers, besides the soil is fert
well adapted to the production of cotton, corn, and small grain of various kind

On the lower part of the river tide-water rice is cultivated by irrigation. T
probably a greater bulk of this crop annually harvested and shipped than in an
section of South Carolina.

Mosquito Creek is a very crooked tide-water stream, which connects Winy
with Santee River. The middle portion of the creek is so narrow and filled
be impassable for even small boats, but either end is wide and deep enough f
nary steamboat navigation. It is said that years ago Mosquito Creek at ever
was sufficiently wide and deep to allow boats of considerable size to pass throu
vessel drawing 5 feet was known to go this way from river to bay.

From long neglect and disuse the creek became filled up and narrowed to i
ent condition. The sea-outlet or bar at the mouth of the Santee River is ve
low, probably having only 3 feet of water at low tide. In consequence of t
very difficult for safe and easy navigation. In every direction at the mout
flats extend to quite a distance, rendering any improvement towards deepen
bar expensive and not expeditious. For these reasons no known attempt h
been made towards improvement in this way. Therefore, on account of the
state of things thus existing at the mouth of the river, it was thought advisa
economical to provide an outlet to the sea elsewhere for the commerce comi
the large area of country which this river drains. With this in view more t
attempt has been made to complete this route, both by way of Winyaw B
through Cooper River. So far as known, all efforts to improve this river hav
directed in furnishing this outlet, inasmuch as this matter seemed to have been
importance in this connection, all of which will be explained in the followin
and extracts touching upon the history of the river's improvement:

1734. "Whereas: The passage to and from Winyaw is much impeded by m
sand filling up the usual passage called the Breach; Be it therefore enacted,
authority aforesaid. That a cut or cuts be made and kept open, at or near t
of the Barkesdale Creek to old Towns Creek, at the discretion of the commis
hereinafter named, sufficient for a boat that draws 4 feet of water, the charge o
cut or cuts shall be bourne by the inhabitants of the parish of Prince Frederick

1786. An act of this year was passed to form a company to cut a canal from
River to Cooper River, thence to Charleston.*†

1809. An act of this year was passed to establish a company to cut a can
Sampit River into Santee River.*‡

1879-'80. An act of the United States Congress of March 3, 1879, provided
examination of the Santee River.

The examination was made under the direction of Capt. Charles B. Phillips
of Engineers, in the following November. Captain Phillips recommends t
sum of $104,427 be expended upon the improvement, which would include an
to Winyaw Bay via Mosquito Creek, or a route further up from Minim Creek
to Winyaw Bay.§

1881. An act of Congress of March 3 appropriated $22,000 for improving
River by deepening and straightening its outlet to Winyaw Bay through M
Creek.‖

---

* Extracts from back acts of South Carolina legislature.

† This canal was actually either partially or entirely completed, but th
proved too narrow and shallow for successful service, and hence it was aban
This work is fully described in one of General Q. A. Gillmore's reports, pa
Report of Chief of Engineers for 1881.

‡ An old canal which crosses the public road between Georgetown and South
8 miles from either place, shows to have been partially excavated. It was ev
abandoned before completion, and it is not known which of the above acts r
this particular work.

§ See Annual Report of Chief of Engineers for 1880, page 917.

‖ See Annual Report of Chief of Engineers for 1881, page 11.

Capt. James Mercur, Corps of Engineers, United States Army, assumed control of work upon the death of Captain Phillips, June, 1881.

1882. Mosquito Creek was surveyed this year under direction of Captain Mercur, formed a project for the work, which was approved.

The project contemplated completing the passage from Winyaw Bay to Santee ver by making certain cuts and using some portions of Mosquito Creek, so that a pth of 6 feet at low tide and a width of 30 feet at same stage of water would exist every point on the route. The project also embraced the construction of a draw-dge over Mosquito Creek.

About this time strong and persistent opposition to the work proposed arose among rice planters on the Santee end of Mosquito Creek, headed by Mr. R. I'on Lowndes, elf a prominent planter, upon the ground that the irrigating fresh water in Mos-o Creek would be destroyed by the United States Canal projecting salt water Winyaw Bay into said creek, thus damaging their rice crops.*

Captain Mercur therefore had full tidal observations taken in Santee and Winyaw, the result of which he based his opinions to the effect that the planters had thing to fear from salt water injuring them, as coming from Winyaw Bay via pro-d work of United States. Upon this subject Captain Mercur made a full and con-ing report.

1882. Mr. W. A. Moore, assistant engineer, was placed in local charge of the work year. An act of August 2 appropriated $20,000 more for this work.

1882–'83. The work both for dredging and building bridge was advertised in the l manner, but no bids were received for the former, and those for the latter were idered too high. For these reasons authority was granted for doing the work by d labor and machinery.†

Mr. L. P. Miller, of South Island, S. C., the originator and indefatigable friend of work, who never despaired during its darkest hours, when most opposed by the bined force of all the rice planters on or near Mosquito Creek, made up a com-y composed of four gentlemen residing in Georgetown, who, with him, subscribed necessary funds, which enabled him to build a first class rotary dredge, Allen est. This dredge was furnished by agreement to the United States to do the k of dredging. Before active operations had really begun, but after the work ordered to be commenced, this work was countermanded at the request of the ators from South Carolina to the Secretary of War.

The object in thus stopping the work was to give Mr. R. I'on Lowndes an opportu-ity to be heard for himself and others in opposing the work.

The Secretary of War, after giving Mr. Lowndes a full hearing, ordered the work be resumed. (See indorsement of Secretary of War of date March 3, 1882.)

1883–'84. The work of dredging the first cut was commenced on Mosquito Creek, bout 1.7 miles from its Santee mouth, on Miller's main canal, the 18th day of July, 83. The dredge at once encountered large cypress stumps (and they continued for 00 feet) on the line of the cut, which was not expected.

Reid Whitford was placed in local charge of the work November, 1883, vice W. A. oore, resigned. Captain Mercur was relieved of the control of the work by Captain A. Hinman, Corps of Engineers, United States Army, in March, 1884.

To the end of the fiscal year 1884, the following had been accomplished: Six rice-ld trunks, 30 feet by 6 feet by 3 feet, were constructed of pine lumber and bedded the irrigating ditches leading from L. P. Miller's land into the canal. The most these were either damaged or moved from their positions, because of the canal nk caving under the weight of the deposited material. Two flat-bottom boats were ilt for cross-sectioning and surveying purposes. Some temporary revetment of ne piles and brush were constructed at low places in the bank to prevent the exca-ted stuff from running back.

A coffer-dam dike was built behind the dredge so that she might have a fixed height still water, to save the expense of raising and lowering the crane as the tide rose d fell, and at the same time the volume of water thus held in the cut kept the banks om excessive caving. Three hundred and fifty feet of movable retaining wall was epared and operated. This was made in 10-foot sections of 1¼-inch plank, with 3 inch 3 inch upright posts and braces. This wall was placed about 10 feet from the ge of the cut and parallel to it, to hold back the deposited material which would herwise have run back and lessened the depth dredged. The wall was moved up d reset as fast as the dredging advanced.

The dredge cut 30 feet wide and 5 feet deep at mean low water, a total distance of 60 feet, and removed 58,317 cubic yards of material, 501 stumps, and 1 log.‡ An of July, 1884, appropriated $15,000 for this work.

884–'85. Captain Hinman was relieved by Capt. W. H. Bixby, Corps of Engineers, ited States Army, in August, 1884.

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* See Annual Report of Chief of Engineers for 1882, pages 1110 and 1111.

† See Annual Report of Chief of Engineers for 1883, pages 870 and 871.

‡ See Annual Report of Chief of Engineers for 1884, pages 1050, 1051.

During the fiscal year ending June 30, 1885, the following work was done:

Five thousand nine hundred and fifteen feet more of the cut was excavated width of 30 feet and to a depth of 5 feet at mean low water.

The quantity of material removed therefrom amounted to 47,625 cubic yards of and sand; also 4 large cypress logs found buried in the soil.

Operated 6,040 feet of retaining mud-walls, and built 500 feet of new wall.

The coffer-dam dike was moved up and rebuilt nearer the dredge. Veins of h sand were come in contact with in such amounts as to greatly retard the progres the work.

A careful but cheap stadia survey was made of the entire length of Mosquito Cr and also of the line of cutting.

Captain Bixby recommended that this work be completed under the existing p ject, namely by cutting 30 feet wide and 6 feet deep at mean low tide, and that improvement be extended up the Santee River proper; the draw-bridge also be c structed over Mosquito Creek. He does not at present recommend any width grea than 30 feet or depth more than 6 feet at low tide be made in straightening M quito Creek.*

1885–'86. Work of dredging was continued under the existing project till Novemb 1885, when the work ceased for the want of funds.

From the end of June, 1885, to the end of November, same year, the following w was done:

The dredge cut a distance of 1,835 linear feet and removed 13,354 cubic yards of terial (for the most part hard sand, which was difficult to excavate), 3 logs, an stumps, found under the surface of the ground.

The foregoing work completed the cut to its intersection with Lagoon Creek, thus water connection was made between Winyaw Bay and Santee River. After dredge had reached this point she was turned back over the cut to remove the sli which had come in after her. The funds, however, were exhausted before the could be in this way cleaned out or deepened to its original depth and width, and machine only succeeded in removing slides to the amount of 2,073 cubic yards bef the work had to be stopped.

The present least available width of the cut is 18 feet and its depth 3 feet at tide.

In December, 1885, Mr. Lowndes again brought up the question of damage to rice lands by the salt water, which he said, would flow through the United States nal from Winyaw Bay into the Santee end of Mosquito Creek, and thereby tota prevent his using the Mosquito Creek water for irrigating purposes, as he had d heretofore. Mr. Lowndes pressed his side of the question with unfaltering pe nacity.

In this connection extensive water-tests and current observations were made, numerous surveys and maps completed, all of which, together with an exhaust report on the same subject, was forwarded in February, 1886.

The tidal and other observations upon the whole went to prove that Mr. Lownd fears were groundless, and that the present necessity for a tide-lock in the Uni States Canal as he wished could not be at once seen.

It was admitted, however, that there was a possibility of salt water finding its w into Mosquito Creek across the South Island sea-beach into the lagoon, and aft wards through the United States Canal.

Captain Bixby recommended that if any decided indications of damage were s coming from this direction the canal be closed by the coffer-dam dike at once.

Owing to the width of the cut, and its shallow depth at certain points, caused slides, it could not be of much use to commerce till they were taken out, and for th reasons the closure of the canal in its present condition would place the public at inconvenience than under other circumstances.

For the above-mentioned reasons, and also because a northeast gale was prevail along the coast, forcing the water over South Island beach, Captain Bixby deci to close the cut, which was done in April, 1886. A second and important rea however, for its being closed was to enable daily and exhaustive tidal observati to be made, in order that the necessity of a tide-lock might be determined.

Mosquito Creek draw-bridge, which is 235 feet length over all, with a clear ro way width of 10 feet, was commenced in February, 1886, and completed in April lowing the fenders or approaches built this month. The work was done by hi labor, and machinery and material purchased in open market. The draw is of rolling pattern operated by an endless chain and windlass. The clear span is 44 f but 4 feet of this is taken up with fender piles, so that really the draw opening is feet in the clear. The bridge is well constructed of first class material, works v satisfactorily, and was built within the amount allowed for it ($2,500). Prior to beginning of work upon it in February considerable time was consumed in getti

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* See Annual Report of Chief of Engineers for 1885, pages 1119, 1120.

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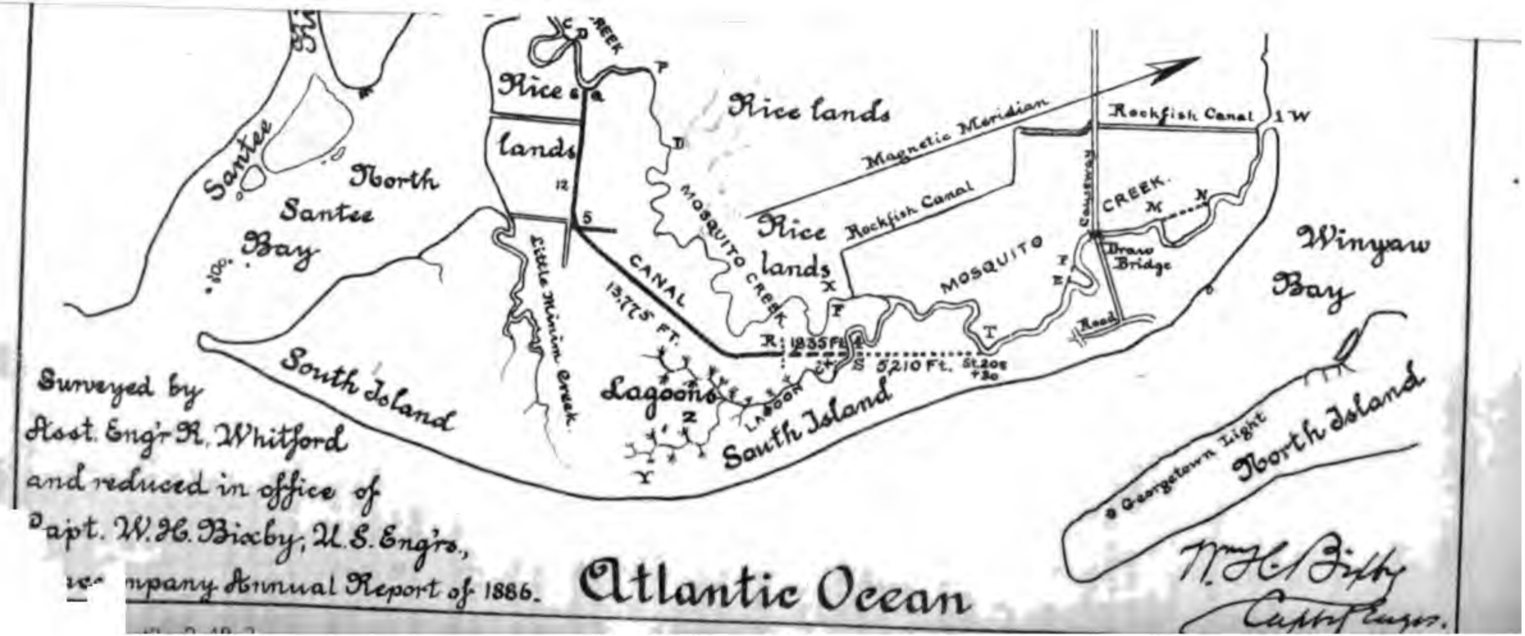

Surveyed by
Asst. Eng'r R. Whitford
and reduced in office of
apt. W. H. Bixby, U. S. Eng'rs.,
mpany Annual Report of 1886.

Wm. H. Bixby
Capt. Engrs.

aterial for its construction on the ground. This was owing to the intense cold which swept over the country about then.

ce the closure of the United States Canal in April daily tidal and water tests been made, and samples of water bottled at the dike and Santee end of Mosquito k.

addition to this, tidal observations have recently been begun on the Santee side Mr. Lowndes' lock, for the reason that Mr. Lowndes has stated that the opening of United States Canal has not only destroyed his irrigating water but also damaged drainage.

he observations now being made will finally settle both questions, it is hoped.

eports have been and will be forwarded monthly in regard to these observations.

ast month the dike in canal began to leak, and after several attempts made to p it by filling with sand-bags and mud without success, it was determined to con- ct a new and stronger dike and fill to the high-water line with mud. This was during the present month. The dikes are built of parallel rows (from 6 to 8 feet t) of sheet-piles driven across the cut and nailed to cap and mud sills. Wing- s built in the same way extend from each corner of the dike and reach well into canal's banks.

he first dike built was not filled in sufficiently soon after its completion, but the t was filled in immediately, and it is reasonable to suppose that it will remain t.

rveys have been made and levels run during the month, looking to the drainage he surplus water from the lagoons back into the Santee River via Little Minim k.

he following appropriations have been made for this work:

1 Act of Congress	$22,000
2 Act of Congress	20,000
1 Act of Congress	15,000
Total	57,000

m the foregoing report it will be noticed that this work has been talked of and ied on at intervals for the past one hundred and fifty-two years. It appears to e been considered an enterprise of great commercial importance and necessity, l thousands of dollars were expended years ago by private companies in their efforts complete an outlet for the Santee River.

RECOMMENDATIONS FOR NEXT SEASON'S WORK.

t is respectfully recommended that Lagoon Creek be diked off as soon as possible, surplus water drained from the Lagoons into Santee River via Little Minim Creek, dikes be removed from the cut and the slides taken out, so that the cut may have full width (30 feet) and depth (6 feet) at low water; that the cut be completed n Lagoon Creek to Mosquito Creek, and such other cut-offs be made, and such tions of the creek to be used be widened and deepened as may be deemed neces- y.

fter the cut is finished from Lagoon Creek to Mosquito Creek it is recommended t the other side of Lagoon Creek be diked off also. It is thought that the neces- y turnout should be excavated also, and the whole line from Winyaw to Santee be pared as far as possible for the use of the public.

t is thought that only one turnout requires excavating especially for that purpose, he others will be furnished at convenient intervals by the sections of the creek off.

t is further recommended that the line of the cut M N on the Winyaw side be nged so as to make the Winyaw outlet a shorter distance from the bridge by going at some point southeast of the present Winyaw mouth of Mosquito Creek. This ld give the entrance to the canal a better protection from prevailing winds, and he same time avoid the mud flat at the mouth of the creek.

o reason is known why the depth dredged would not remain as permanent as at mouth of the creek. For similar reasons the cut A B on the Santee side is espe- lly recommended to be made.

t is thought that the cuts C D and E F should also be completed.

he map herewith sent shows the cuts completed and those left to be made.

COMMERCIAL STATISTICS.

is thought that there has been very little, if any, change in the commerce on this r from that reported last year. The usual quantity of tide-water rice was shipped, cotton and naval stores amounted to about the same as last year. These conclu- s are based upon facts furnished by the agent of the South Carolina Steamboat

Company, at Charleston; but his statement was not sufficiently comple te,becau
accounts of the large quantity of freight carried by boat to the Santee Bridg
shipped thence by rail could be gotten.

Mr. T. S. Martin, who has filled the position of overseer upon this work wit
usual faithfulness and efficiency, deserves much praise, and I take pleasure in s
ing thus of him.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engine

To Capt. W. H. BIXBY,
Corps of Engineers, U. S. A.

Commercial statistics for improving Santee River, South Carolina, for the fiscal year
ing June 30, 1886, furnished by William P. Holmes and B. I. Hazzard, sr.

Articles.	Quantity.	Val
EXPORTS.		
Cotton........bales..	12,350	$5
Naval stores........barrels..	25,430	2
Rough rice........bushels..	150,000	2
IMPORTS.		
General merchandise........tons..	9,400	4

Total value of exports and imports........ $1,4

The commerce has been carried on by steamers of the South Carolina Steam
Company's lines, together with numerous small craft, consisting of sailing ves
pole flats, &c.

No accurate account could be gotten of the lumber, timber, shingles, crude tu
tine, game, fish, furs, &c., transported over the river during the past year.
thought that these items would considerably swell the total values of exports.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., March 6, 18

SIR: I have the honor to submit the inclosed communication
the Committee on Rivers and Harbors of the House of Representati
dated January 27, 1886, requesting information in regard to the "
provement of the Santee River, South Carolina, by dredging
straightening its outlet to Winyaw Bay through Mosquito Creek,"
its relation to the rice lands in its vicinity and supposed injury the
and to invite attention to the accompanying report upon the sub
from Capt. W. H. Bixby, Corps of Engineers, which contains info
tion of much interest and value, and recommend that it be transmi
to the Speaker of the House of Representatives for the informatio
the Committee on Rivers and Harbors.

Very respectfully, your obedient servant,

JOHN NEWTON,
Chief of Engineers,
Brig. and Bvt. Maj. G

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

L REPORT OF CAPTAIN W. H. BIXBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., February 25, 1886.

Certain persons own rice lands upon Mosquito Creek, South Car-
in the vicinity of the canal now being cut by the United States
nment under appropriations for the improvement of the Santee
by widening and deepening its outlet to Winyaw Bay through
ito Creek. These persons have lately made complaints that the
g of this canal had injured their rice interests and would injure
ice cultivation this next summer. In consequence of these com-
s, I have had a careful examination made as to this claimed past
and the possibilities of future injury. This examination was in-
d to Assistant Engineer Reid Whitford, who has had local charge
improvement of the Santee River for the last two years. His re-
ull and thorough, is herewith appended, accompanied by foot-notes
by Mr. R. I'on Lowndes, who represents the rice interests, asking
tion. A great many rice planters have submitted sworn opinions
hat they think will happen next summer if the canal remains open,
these opinions are far from unanimous and are almost entirely
tical, I have not thought it necessary to forward them. I find the
ast injuries are those caused by the fears as to future injury. The
r from future injury I regard as slight.

condition of matters at present may be stated as follows: The rice
of Mosquito Creek border on the creek from P to X (see appended
, and in summer must be irrigated by fresh water, obtained mainly
he creek between Q and X. During the summer Winyaw Bay is
lly salt at all stages of the tide and pours salt water into Mos-
Creek via its Winyaw Bay mouth (W). During summer the Santee
is generally fresh during a portion of each tide. These two waters,
antee River and Winyaw Bay, have been separated heretofore by
gate at X, which opened automatically to allow water to pass
l Winyaw Bay, but closed automatically to prevent water from
g toward the Santee. When fresh water from the Santee River
p Mosquito Creek it was allowed to push all the impure, brackish
water through the tide-gate at X, and the fields from Q to X
hen irrigated with this fresh water before the arrival of the next
ment of salt or brackish water. If at this moment this fresh water
taminated by salt water from any source the irrigation of the fields
e abandoned until the next tide, and if several days pass without
ater irrigation the rice crop will be seriously injured if not de-
d.

several years past, at very high tides, salt water direct from the
has passed through the sand dunes of the beach at Y into lagoons
nd thence through Lagoon Creek (Z S V) and Mosquito Creek (V
to Winyaw Bay at W.

June the canal extended only from Q to R, and all salt water
he lagoons Z and from Winyaw Bay (W) backing up Mosquito
(V X) on the Winyaw Bay side was prevented by the tide-gate
m going over to the Santee side.

, the canal extends all the way from Q to S, and free communi-
is thereby opened between the Winyaw and Santee ends of Mos-
Creek. Now, salt water coming direct from the ocean over the
unes (Y) through the lagoons (Z) and Lagoon Creek (Z S), may

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tted; printed in House Ex. Doc. No. 114, Forty-ninth Congress, first session.

go through the canal (S R Q) to the Santee end of Mosquito Cre
Q X), and spoil the water at the moment when irrigation dem
fresh water only. During the high-water season of this winter a
water has already gone that way, and some of the rice planters
that a great deal will go that way during the low water of next sum
Moreover, the lagoons (Z) can act as a head tidal basin for water
both Winyaw Bay (W) and the Santee River (P). During the
water season of this winter the meeting of the Santee and Wi
waters has occurred at a point on the Winyaw side (between S an
of the canal; the lagoons (Z) and Lagoon Creek (Z S V) have se
as a tidal basin for the Santee River water only, and far as know
water from Winyaw Bay (W) has succeeded in getting up into this
basin (S Z); but some of the rice planters claim that next sum
large quantities of salt water from Winyaw Bay (W) will flow thr
Mosquito Creek (W T V), Lagoon Creek (V S), and the canal (S R
and will spoil the water in the Santee end of Mosquito Creek (P Q
at the very moment when irrigation demands fresh water only.

The present projects for the canal contemplate extending the c
from S to T; and then the lagoon water will not be allowed to enter
canal at S, but by an inverted siphon at S, or a side drain (S T) wil
drained off to T on the Winyaw side of the meeting of the Winyaw
Santee waters; so that then the only possible injury to the rice in
ests will be that caused by Winyaw Bay water passing through
canal to the Santee side. If this occurs it must be prevented by
use of a tide-gate in the canal between S and Q; and the orig
projects of my predecessor contained a proviso for such a tide-gate.
serviceable tide-gate sufficient for several years' use, if needed, coul
constructed in this canal at a cost of not more than $5,000.

A careful consideration of the question as it now stands leads m
the following conclusions:

All the information so far received tends to confirm the opinion
my predecessor, Captain Mercur, to the effect that the Mosquito Cr
Canal when completed will not prove in any way injurious to the
interests of Mosquito Creek.

If the canal in its present unfinished condition is to remain open dur
next summer it is possible that the rice interests at the Santee en
Mosquito Creek may be injured by salt water coming directly from
ocean over the sand dunes, or coming directly from Winyaw Bay,
entering the creek at the Santee end by way of the Government
nal. I do not think such injury probable, but yet it is possible.
possible loss to these rice interests in one summer is from $50,00
$100,000.

If at any time next summer such injury should in my opinion app
probable and immediate, I should have the canal closed immediately
a temporary coffer-dam dike, constructed at once at an expense of $
or less from materials and by means of funds which I have retained
that purpose from the existing appropriations. This closure of
canal will completely protect the rice interests of Mosquito Creek.
this closure can be made at any time upon a few days' notice, I sh
not do it until actually necessary.

If such temporary closure of the canal becomes necessary, I shou
at once recommend the construction in the canal of a small and co
paratively inexpensive tide-gate to cost not over $5,000, which ga
would allow the resumption of canal traffic while protecting and ev
benefiting the rice interests of Mosquito Creek. This tide-gate wou
be automatic in its action, and would of itself remain open half of ea

during summer; it may further be allowed to remain open all day ing winter without injury to the rice interests of Mosquito Creek. the possible need of such a tide-gate, was foreseen and referred to the original projects under which past appropriations were voted for work, the cost or construction of such a tide-gate, at any future ent when its actual need should become evident, might be considas a proper expenditure under the appropriations for the comple of the canal.

In submitting this report I request also an approval of the line of ion which I have here outlined as in my opinion necessary to protect rice interests of Mosquito Creek, while the Government canal rein its present unfinished condition.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain of Engineers.

he CHIEF OF ENGINEERS, U. S. ARMY,
(Through Lieut. Col. W. P. Craighill, supervising engineer.)

[First indorsement.]

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., March 1, 1886.

espectfully forwarded to the Chief of Engineers. Capt. W. H. by's views are approved.

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., February 10, 1886.

APTAIN: In compliance with orders contained in your letter of 17th December, (No. 7086 Sn. '85), I have the honor to submit the detailed report that follows, reference to the present or future injury to the rice lands bordering on and near osquito Creek, by salt water entering that creek through the United States canal, has recently been connected with Lagoon Creek.

mit me to preface these remarks by giving a brief statement of the method in al use in this vicinity of cultivating the rice lands on the irrigating system.

is information has been kindly furnished me by Mr. John A. Hume, a rice planter g experience and a gentleman of high standing in this community. Mr. Hume's thy and thorough vocation as a planter of rice well fits him to be authority on this ect.

e planting season begins about the 1st of April of each year and continues at invals until the middle of June. There are two ways of planting rice, namely, the en trench" and the "covered." The "open trench" is most used here now. Soon e seed is sowed in open trench it becomes necessary to flow the fields with pure water to a depth of about 1 foot. This water remains on the rice from ten to ty days, at which time it is drained off, the seed having sprouted to a height of t 2 inches. The land is kept dry for about three days to allow the rice to take root in the soil, and it is then flowed again with pure fresh water to protect the g rice from the ravages of the birds and also from being dried up by the sun. is known as the sun, the point, or bird flow. At the end of three days, if this is used as a long point, the water level is lowered until the leaf is just visible in depressed portions of the field. The object of the long point is to kill the growing and to force the rice forward. The water level remains lowered for about eightdays, when the flooded fields are dried for some thirty days. During this period rice is hoed twice and picked of weeds.

At the end of the thirty days' drying the lay-by or harvest flow is put on, which ld, as usual, be pure, fresh water, and allowed to rise in the fields to a height corponding with the long-point flow, and thus kept for ten days. This water is then wn off, having become impure by stagnation, and fresh water is run back at the next d tide to a height exceeding that of the former flow by about two inches.

The water is now exchanged weekly for a fresher supply, until the crop is ripe, it is then dried, so that it may be cut and harvested, which is generally done d September and October. No more irrigating water is wanted until the next year's

During the progress of the growing rice crop, from first to last, it is subject t following damages or destruction:

(1) Ravages of black-birds or May-birds.

(2) In the dry growth, grub-worms eating the roots.

(3) In the water growth, maggots eating the roots.

(4) Ravages of the black and rice birds when the rice is in milk, beginning i gust.

(5) Strong winds whipping off the blossoms and heads, high tides and heavy flooding the fields to such a depth as to cause the lower leaves of the rice to she

(6) Salt gale tides will at any time totally destroy the entire crop, and they are stantly a source of uneasiness to the planter, but they are more particularly exp in autumn. When the salt tides leave the lands quickly the crop *may be* saved, a damaged condition. However, all cut rice lying in the fields is generally t lost when the fields are thus swept over by storm tides:

Remedies for the above:

(1) Keep out birds as best they can.

(2) Flow one tide in and then immediately out. The water should be fresh and kill the grubs.

(3) Dry the land for three days, thus allowing the heat of the sun to kill the mag after which put fresh water back. Maggots are caused by impure irrigating w They appear at the time of the last or harvest flow when the rice is not injure drying for three days.

(4) Keep out birds as best they can.

(5) No remedy.

(6) No remedy.

It will be seen that the cultivation of tide-water rice requires a succession of f ings from beginning to end. Therefore, taking into consideration the foregoing f it is reasonably concluded that rice must have for its successful production by ir tion pure, sweet fresh water. The rice planter studiously avoids the admissi brackish water into his fields, as it means serious damage to his growing crop.

In addition to the former condition of Mosquito Creek and the adjacent rice la I am also indebted to Mr. John A. Hume for the following information concer the above subject. Mr. Hume has been a planter since 1839, having been born in He says that as far back as 1824 rice was planted on about 500 acres of the lands b dering on the west side of Mosquito Creek, and, as well as he remembers to have b told, even then owned by the following planters:

Maxwell ....
Lowndes (grandfather of R. I'on Lowndes)..
Hume (father of John A. Hume) ....

There was no bridge across Mosquito Creek at this early day. The creek was from Winyaw Bay to Santee Bay for the passage of flat-boats 50 feet long, 12 feet and 3 feet deep. The first crop of rice ever planted by Mr. Maxwell on Mo Creek was entirely destroyed by the great storm of 1822. Mr. Hume gathers al above from conversations held with his father. What follows he states as co within reach of his own recollection. The first bridge across Mosquito Creek built in the year 1836. At this date all the rice lands on Mosquito were culti except about 200 acres, prepared since by Mr. Richard H. Lowndes, father of M I'on Lowndes, and the Ford land, now owned by Col. L. H. Miller. For a nu of years after this time, Mr. Hume has known flats as above mentioned to go thr Mosquito Creek from bay to bay. He was a resident of South Island for about years, beginning in 1839, and that previous to this year he often visited his fat plantation on Mosquito Creek, and which he himself afterwards planted with co uous success.

In early days the planters feared the damage from salt water from the ocean sw ing across the beach and the low-lying marsh lands upon their rice fields during tides, and that as far back as forty years ago Mr. Hume, in company with Mr. lins Lowndes (uncle of the present Mr. R. I'on Lowndes), Mr. F.W. Johnstone (of the present Mr. William C. Johnstone), Mr. F. W. Ford (father of the present Morris Ford), and Mr. Elias Doar (father of the present Mr. T. W. Doar), all pro nent and wealthy planters, visited a point on Lagoon Creek near the place where line of the United States Canal now crosses that stream, with a view of matur plans to dike off, by their own private means, the overflowing sea-water; but some reason, not now remembered, this proposed scheme was not carried out. years 1844 and 1845, especially 1844, were known to the old-time planters on Mosqu Creek as salt years, because all their irrigating water became salt and so remai e entire rice season. This was due to an unusual drought of long duration in country and the consequent extreme low water in the rivers. Mr. Hume was lanting on Mosquito Creek, and he states that his land in the year 1844 only ced 3,000 bushels of damaged rice, when generally the harvest amounted to about bushels of an excellent quality. He did not even attempt to use the water from uito Creek, that being entirely too salt at all times to risk in flooding the rice, hat he drew his supply of water from China Creek, a stream some distance above uito and not often subject to salt tides, but even that source was sufficiently ish to almost entirely destroy his crop. As well as he remembers, the salt ex- d as high up the Santee as the upper mouth of Minim Creek.

spectfully inclose copies of affidavits (Nos. 5, 6, 7, and 8) of Messrs. Simons Lu- L. G. Ford, E. G. Hume, and E. M. Lucas, relating to the foregoing subject—viz., rmer condition of Mosquito Creek, &c.—gentlemen well and favorably known is section of the State. These copies were furnished by Mr. L. P. Miller, the als of which were forwarded to the United States Engineer at Norfolk several ago.

e United States Canal was begun on the 17th of July, 1883, at a point on Mos- Creek about 1.70 miles above its Santee mouth, and was completed on lines as n on sheet F to Lagoon Creek the 1st of November, 1885. The cut was executed width of 30 feet and to a depth of 5 to 6 feet at mean low water, but these dimen- have since changed at several points by caving banks and slides to a least width out 18 feet and to a least depth of 3 feet at mean low water. The distance from e River to Lagoon Creek, via Mosquito Creek and the canal, is 4.68 miles. Dur- he autumn of 1883, and the winter, spring, with a portion of the summer of 1884, were made by Mr. W. L. Miller, United States rodman, and Mr. Thomas S. Martin, d States overseer, to discover the existence of salt water in the cut behind the e at high and low tides. Copies of the results* of these tests are respectfully herewith. Mr. Miller's observations were taken between the initial point of the nd station 20 (stations 100 feet apart), and shows the water to have been salt at een low waters between the dates of October 5, 1883, and January 3, 1884, in- re, covering the same period the water was salt for fifteen high waters.

Martin's observations were taken between the initial point and station 70, and s only one salt tide, which occurred February 20, 1884. The following facts are cted from the official records of the Santee work of dredging as kept by Overseer n:

easterly gale prevailed along this coast in September, 1884 (10th, 11th, 12th, 3th), forcing the salt water over the marsh lands bordering on Mosquito Creek agoon Creek to a depth of about 2 feet, the vertical rise of the tide being about above mean low water.

United States Canal had at that time reached a distance of 9,070 feet from its ning. The depth of this overflow was sufficient to cause the dredge to suspend tions for ten days because of the difficulty experienced by the laborers in cut- and trimming the sides of the cut ahead of the dredge with their saws and a. On the 11th of October, 1885, the marsh lands were again flooded by an east- gale with salt water coming across the beach from the sea, and on this occasion rtical rise of the tide was 6 feet above mean low water covering the marsh lands epth of 3 feet. The dredge had reached a point within 500 feet of Lagoon Creek 5,150 feet from its beginning. This surplus water was rapidly carried off by the d States Canal, permitting the dredge to resume excavating after a stoppage of lays. So great was the force of the water being driven across the sea beach by ccompanying strong wind against the United States Canal bank that about 40 n length of the bank gave away and was swept into the cut. The bank at this was composed of sand and mud, having a bottom width of about 60 feet, a top width of about 10 feet, with its crest reaching to a height of about 8 feet the mean low-water level in the canal. Subsequent to this gale the water in anal was salt until its junction with Lagoon Creek, which was accomplished on mber 7, 1885[1]. A copy of Mr. Martin's official report to me in regard to this mat- respectfully inclosed.

m all I can learn from parties who are best calculated to know whereof they , it has always been an established fact that the Santee end of Mosquito Creek ore or less salt for several days in succession, on the ebb tides, after every east- low.[2]

o portion of the United States Canal had been in existence at the times of the , in September, 1884, and October, 1885, the ebb tides in the Santee end of Mos- Creek would doubtless have been salt or brackish for some considerable time the cessation of the blows, for no little quantities of the salt sea water would have ally worked its way on every tide toward the Santee River and Mosquito Creek, the low banks and through the drainage ditches along the adjacent neglected ields.[3]

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* Omitted.

[illegible] the flooded marsh lands more rap
[illegible] have been done.
[illegible] as being in the Santee end of Mosquito Cre
[illegible] of those whose lands were supp
[illegible] through them, on the flood, into sc
[illegible] and prevent this waste water from
[illegible] the proper side.
[illegible] there was a freshet in the Santee Riv
[illegible] all stages of the tide, and when there was
[illegible] during the first of the flood, and afterwa
[illegible] the sea.
[illegible] the last of every ebb tide, at any stage of
[illegible] runs in, a portion of this fresh ebb is for
[illegible] which gives the planters along the creek a su
[illegible] fields before the arrival of the following sa
[illegible] water."
[illegible] the wet season, when there are freshets in
[illegible] of the tide at the mouth of Mosquito Creek. I
[illegible] water. During the freshet season, however, i
[illegible] ebb. It is salt there at all stages of the tide

[illegible] of the tide the Winyaw end of the creek is c
[illegible] fresh on the last of the ebb no reason is know
[illegible] fresh water" would not work the same on th
[illegible] Santee end, which would tend to freshen at lea
[illegible] of Mosquito Creek. When the bay is salt at a
[illegible] correspondingly. However, it is thought tha
[illegible] is generally spoken of as salt and the Santee en
[illegible] of the Winyaw end of Mosquito Creek get
[illegible] the beach, thence through the lagoons into La
[illegible] touched upon hereafter.
[illegible] Mr. John A. Hume that the rice lands alon
[illegible] of aluminum, and that on this accoun
[illegible] with fresh water, because the aluminum
[illegible] the stagnant water resting upon the lands. H
[illegible] removed from the coast do not contain this i

[illegible] data showing when or where the rice interest wa
[illegible] Winyaw Bay into the Santee end of Mosqui
[illegible] bay to bay, nor have I ever heard that the ol
[illegible] this direction.
[illegible] information I have been able to collect regarding th
[illegible] creek or the rice lands in connection therewith.

[illegible] OF MOSQUITO CREEK, THE UNITED STAT
[illegible] OBSERVATIONS JUST COMPLETED BY THE UNDE

[illegible] proceeded to the United States Canal on Decemb
[illegible] Lowndes by appointment. In going thither I too
[illegible] sheet F, where the water was found brackish wit
[illegible] so continued until arriving at a point in Lagoo
[illegible] of the United States Canal, the water he
[illegible] fresh flood from the Santee River having reache
[illegible] the United States Canal was perfectly fres
[illegible] foot at the mouth of the said canal, th
[illegible] towards the Santee River, became brackis
[illegible] at 11.1[illegible] a. m., and at 4.25 p. m., it ha
[illegible] from the Santee end of th
[illegible] distance of 14.40 feet in fou
[illegible] was very light from the south. From about th
[illegible] States Canal [illegible] marked 5 on sheet F, th
[illegible] water in Mos
[illegible] this point. On this
[illegible] mouth of said canal
[illegible] vertically on the

[illegible] from the Santee River
[illegible] at the time an
[illegible] 1 foot. Return

nediately into the United States Canal above its mouth, the ga
with the ebb current still running out. This was only a few minu
and subsequently very little, if any, more brackish water was discharged
ito Creek on that tide by the United States Canal.

ill be readily seen that the amount of water damaging to the cultivation of rice,
the United States Canal carried into Mosquito Creek on this ebb tide, amounted
y little.[7] The next day, December 22, ebb tide was of the same character
ckish water, and on this occasion it reached as far down Mosquito Creek as
Creek Canal (B on map), when the fresh water flood was met coming up the
I returned to the mouth of the United States Canal and waited there for the
lood. When it came up we allowed it to drift the boat up Mosquito Creek, past
outh of said canal, with the tide and water a little brackish,[8] and we continued
ahead of the fresh, until we arrived at a point on Mosquito Creek marked P on
F, where we left the boat at 9 p. m.

brackish water doubtless was a part of that which came out of the Government
the last of the ebb. It must be borne in mind also that a considerable portion
above water is carried back up the United States Canal at the flood tides. Now,
erfectly evident that whenever there is brackish water at the source from which
regoing came, it will be carried down the United States Canal at every ebb tide,
ntities *more or less large*,[9] depending upon the direction of the wind mainly,
e volume of fresh water in the Santee.

n the winds prevail with strength from the west for several days in succession,
sing the low-water levels in the adjacent streams and bays, then if there should
brackish water subject to be carried into Mosquito Creek by the United States
from Lagoon Creek, it may reach a point below where I have fairly observed it
met the incoming fresh water flood, but just exactly what this excess of dis-
vould be I am unable to say without first having observed the currents, espe-
pon a tide when all the conditions suited.

may be considered an exceptional case, however, but it *might occur* at the very
the rice-culture season.

ct to be understood that the United States Canal carries brackish water into
to Creek on every tide, for it has been observed to the contrary, viz: Thomas S.
current observer, reports to me officially that on January 19, 1886, no brack-
er went through the United States Canal from Lagoon Creek. He (Martin)
nouth of canal all day, taking velocities of currents and testing water. Jan-
water fresh in United States Canal and Santee end of Mosquito Creek at both
flood tides. January 27, water fresh in United States Canal at all stages of
Martin followed last of ebb down the canal to Mosquito Creek and found
esh. He then went with first of flood up Mosquito Creek to point D, on sheet
ound the water fresh all the way.

D. Martin, gauge observer, reports to me officially that on February 4, 1886,
the gauge in the United States Canal at 300 feet above 6 (see sheet F) to read
= mean low water) and the water fresh.

g proven that brackish water did find its way at intervals through the United
anal into Mosquito Creek, it next became necessary to ascertain from whence
ure water had its source. With this in view many current and tidal observa-
re taken at the junction of the United States Canal with Lagoon Creek, at sev-
s, both ebb and flood. This was accomplished with a log and line floats and by
g the flow of water with the eye. Mr. Thomas S. Martin, who has had expe-
the United States Coast Survey, as gauge observer, on the coasts of South Caro-
th Carolina, and Maine, from March, 1877, to May, 1880, and who has had con-
e experience in observing the flow of the currents at various places by using
and line, was employed to observe the currents at the above place under my
n. The results of Mr. Martin's observations are respectfully forwarded here-
shown on sheets *A, B. C, D, and a copy of his explanatory report accompany-
e sheets. As a check on these results Mr. E. D. Martin was sent to observe the
at the same place, which he found upon the whole to agree with the above.
here myself afterwards to do the same work, as a check to both statements,
atisfy myself that there was no error. My own results showed no difference
had already been made known. I was plainly convinced that the flood tides
ntee River and Winyaw Bay meet practically anywhere from about 300 feet
e point of junction of the canal with Lagoon Creek and a point in that creek
ree-quarters of a mile farther down. This point varies according to the di-
and strength of the prevailing winds and the volume of freshet water in San-

beginning of the flood tide, which pours through the United States Canal into
Creek, the current there turns to the right and runs up Lagoon Creek into
ons. This current is soon joined by that of the flood from Winyaw Bay, at

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* Omitted.

the mouth of the canal, and they together continue flowing up Lagoon Creek, thence into the lagoons, for two or three hours, more or less, after which the S flood divides at the mouth of the canal, one portion of it continuing on up L Creek, and the other down Lagoon Creek, forcing back the Winyaw Bay wa distances as above stated. This flood into the upper portion of Lagoon Creek and logoons reaches approximately 4,500 feet from the mouth of the canal. Upon the tide the water returns from the lagoons, and for from one to two hours the fl only observed going down the canal. After it has thus run for the above tim currents divide at the mouth of the canal, one portion continuing down the c towards Santee River, and the other portion down Lagoon Creek below the mout the canal, towards Winyaw Bay. During the period when the ebb is running down the canal there is no perceptible current in any direction in Lagoon Cree low the mouth of the canal. There is also inclosed a copy* of Mr. Martin's det report to me of the currents and gauge observations taken on time. The reason this rather peculiar movement of the water is thought to be, that owing to the proximity of the lagoons (see sheet E,* which will give you a very good idea of t location and dimensions with the depressed level of the water in the same, that ing been drawn off by the preceding ebb tide), the flood-tide current is irresist attracted into them till they are sufficiently replenished with water to cover t very considerable areas, and raise their levels to an elevation nearly equal to th the water at the mouth of the United States Canal. When this has been accomplis and needing no further the extra supply of water, the current then separates at mouth of the canal, and only enough continues to run up to retain this secured el tion, while the excess of water emptied from the canal turns down the creek, and att and forces back the weaker current coming up from towards Winyaw Bay. Now, w the time arrives for the Santee to take back its water from the canal and that w has gone up into the lagoons, the current begins to return from these places, an the water is hurried down Lagoon Creek into the canal it turns on a curve int canal, and it is thought that the centrifugal force[10] of the water running on the c rim of the curve is sufficient to hold back the water there at rest, preventi from following the outgoing ebb into the canal till the time of the ebb to Win Bay, when the currents gradually fork, which causes that water resting below mouth of the canal to be carried towards Winyaw Bay and the other prong o fork continues through the canal until the next flood. This is repeated on every that we observed. It will be seen that that portion of the water which deflects t left from the mouth of the canal on the flood *does not* return down the canal o next ebb, but flows down Lagoon Creek into Mosquito Creek towards Winyah which, of course, has a tendency to freshen Mosquito Creek to quite a degree.

Having established the facts—

(1) Winyaw Bay was fresh at low tide when the foregoing observations were on January 8 last (and the "pocketing the fresh water system" was working o Winyah end of Mosquito Creek, because the water was found to be fresh at Mos Creek Bridge when the gauge there read 3 feet), and inasmuch as on that day bra water went down the canal towards Santee, from the above alone it was evident the brackish water did not come from Winyaw Bay on that day.[11]

(2) That the *entire* ebb through the canal comes from the upper portion of La Creek and the connecting lagoons.

(3) That the flood tide came up from the Santee River fresh and returned in direction sometimes brackish.

It now becomes desirable to trace the origin of this brackish water. So to thi an examination was made of the lagoons and the sea-beach near by. A line of l was carefully run along the high-water crest of the said beach, starting from bench-mark, securing the mean low-water level at the South Island Wharf, and cross-sections were taken from the extreme low-water line along the sea-beach, s ing the slope of the lands from the high-water crest into the lagoons. All this be seen by reference to sheet E.*

The high-water crest was found to be elevated from 5.7 to 6.9 feet above our e lished mean low-water level. The mean rise of the tide is 4 feet. By allo from 1 to 2 feet rise above this, according to the direction and strength of the w for the height of the inrolling billows, it is conclusive evidence that the sea salt w will run over the beach into the lagoons during flush high waters in quantities ciently large to cause the lagoon water to be decidedly brackish.

This, then, is the true source of the brackish water carried into Mosquito Cre the United States Canal, and it does not come from Winyaw Bay, as has been thou If there was no Winyaw Bay in existence the state of the case would not be cha

It is not impossible that there should be days in succession during a period of erly winds and neap tides when no water from the sea would find its way acros beach. In this case the daily influx of fresh water from Santee would const the lagoons, and at such times no brackish water would go down the canal. , on the other hand, the reverse of this might be the case. However, the amount ckish water that goes down the canal at any time depends entirely upon the tity of salt water which crosses the beach into the lagoons.[13]

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* Omitted.

a time in the dry season when, as is stated, the waters are salt or inclined so . This would make no difference so far as the connection of the canal with Win- Bay is concerned, except that the little portion of the flood from below the mouth canal, which goes with the Santee water into the lagoons, might add just a to the saltishness of the lagoons.

ither would a dry season increase the overflowing quantity of the water from the . It is true that the brackish water carried down the canal into Mosquito Creek the last of the ebb, if in sufficiently large quantities, would somewhat interfere the "pocket system" in Mosquito Creek when that creek became salt at the flood tide[14] from the Santee salt water.

m told that sometimes the Santee River is fresh the entire year, and then there necessity for pocketing the fresh water at low tide in Mosquito Creek, but when Santee is salt at high water and fresh at low water, the pocket system is the only the planter on the upper part of Mosquito Creek has of securing a fresh sup- of water.

. W. C. Johnstone, who has long resided in this vicinity, tells me that he remem- when the sea-beach alluded to was covered by a range of hills, and that on these hills there was a growth of grass, and at intervals there grew trees and brush. only the highest gale tides found their way across the beach. These have all gradually destroyed by winds and storm-tides.

. W. A. Moore, assistant engineer, says, in a report to Capt. James Mercur, Feb- y 1, 1882:

"On the 25th of December (1881, I suppose) I walked down the South Island Beach, from the first hummock as far as the eye could see the tide was pouring over the h, not continuously, but at intervals of about 200 or 300 feet. The tide in Win- Bay rose 4.2 feet above the plane of reference. As Lagoon Creek here is only a quarter of a mile from the beach, I presume it will be the natural drain for overflow. The marsh here at this time had about 3 inches of water on it. The between the beach and Lagoon Creek has a large percentage of sand in it and is ered by a growth of wire grass. I am told when dried it will burn, being of a ty nature."

Mr. L. P. Miller has told me that he has frequently seen the water crossing this ach within the last few years.

I have heard Mr. Thomas S. Martin, ex-overseer of the Santee River improvement, who traveled along the beach daily for more than a year in going to his work at the dredge, say that on one occasion he found the water running so rapidly at a point across the beach that he hesitated about risking to ride his horse through it.

The writer, too, has seen the water crossing the same beach within the last two years, and he has watched with some concern the wasting away of the protecting sands, especially since the breakage in the United States Canal bank during the storm in October last.

It was his intention to offer for your consideration, as soon as more funds were available for the work, a recommendation looking to the construction of some simple "sand-catchers" along this beach, to attempt to restore, in a measure at least, the once existing sand-dunes.

SIMULTANEOUS TIDAL AND CURRENT OBSERVATIONS—THE RICE LAND SUPPOSED TO BE IN JEOPARDY—THE TIDE-LOCK, ETC.

On January 19, 1886, simultaneous readings were taken with gauges set alike on the established mean low-water lever of the Santee River, which is the same level used in dredging the United States Canal, at the lagoon mouth of the canal, and in Mosquito Creek at station 208+30. The height of the water was generally greater at Lagoon Creek than at Mosquito Creek, as will be seen by the tabulated statement of the record which is forwarded herewith. The constancy of this greater height and the peculiar shapes of the tide-curves for this day are probably due to the strong easterly wind prevailing that day.

On February 7 simultaneous tidal and current observations were taken at the following places, with the zeros of the gauges all set on the above established mean low-water level (having previously had bench-marks fixed in the neighborhood of these places, the gauges were therefore thus set with the level, without much time or trouble). About 300 feet above the Santee mouth of Mosquito Creek, in the creek at A, see sheet F for location and sheet G* for cross-section, current velocity, and tidal observations. Three hundred feet above 6 Santee mouth of the United States Canal, in Mosquito Creek, see sheet F for location and sheet G* for other information. Three hundred feet above 6, in United States Canal, see sheets F and G.* At D, see sheet F

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* Omitted.

the ... see sheets F and G*; at
the ... Lagoon Creek, see same sheets
fl ... in the Creek No. 1, and al
C ... sheets F and G.*
d ... represents Rockfish Canal to
l ... and finally becomes a mere d
t ... des' lock, station F. No obser
... who should have observed a
... hence there are no notes for th
... mber 22 I visited Lowndes' lock
... the Santee side about 1 foot lower t
... February, 1886, Mr. Edwin D. Mar
... the difference of the water-level on
... on Santee than on Winyah side. M
... the pencil note to hand me, concern
... spectfully forward to you, as Mr. Lown

... s taken on the 7th of February. On t
... 3.3 feet on the gauge at the Santee mou
... the range 3.2 feet. At the Winyaw mou
... fall 0.4 below zero, making the range
... her at Winyaw Bay than at Santee Rive
... aw Bay than at Santee River.*
... Santee River than at Winyah Bay, and lo
... places. The flood current on the Sant
... d the same current on the Winyah side r
... urrent ran out on the Santee side 1.25 hou
... hours after low water. The tide rose 0
... at the Lagoon mouth of the United Stat
... side, the range at Lagoon Creek being 1.
... occur on an average two hours earlier
... th of the United States Canal. The chang
... occurs 2.25 hours earlier at the Santee,
... ars three hours sooner than at Lagoon Creek
... sooner than at Lagoon Creek.
... of no salt or brackish water (see sheet C),
... ed at the Lagoon mouth of the United State
... canal for some little distance, but met the in
... it had reached Mosquito Creek, and wa

... re was a freshet in the Santee River on this day
... water found at the gauge at the Winyah end
... se and fall of the tides, it is but fair to assume
... Bay also.
... from our own measurement of the United States
... across Lagoon Creek to Mosquito Creek again, at
... steel tape-line, and which is known to be cor-
... from our own stadia survey of Mosquito and La-
... ats on the Winyaw Bay side, which I think is

	Feet.
... Winyaw Bay, via Mosquito Creek to the ... the canal to Lagoon Creek, thence with ... with Mosquito to Winyaw Bay	62,930
... Mosquito Creek to mouth of United States ...	9,570
... Mosquito to Lagoon Creek	15,630
... creeks from the Lagoon mouth of the United ...	37,730
... al from Lagoon Creek to Mosquito Creek. ...	5,200
... Winyaw Bay via the canal finished to sta. ...	49,425
... aw Bay via Mosquito Creek	24,225
... Winyaw Bay via the canal finished to sta. ... wards Winyaw Bay completed	46,560

... veraged current velocities given in feet per second
... of the water caused by the leveling of the tidal

---

*Omitted.

; that is, the actual running time of the currents is taken into consideration, not simply the vertical rise and fall of the water.

one-half of the flood current from the Santee River, which turns to the right leaving the canal, penetrates the upper portion of Lagoon Creek to a distance 000 feet, as it does more or less, it is then thought reasonable to suppose that if rtion of this water was allowed to flow to the right, as is recommended in the er's annual report for Santee River improvement, dated June 30, 1885, viz., the ing off of Lagoon Creek to be included in the work of revetment, the entire vol of the flood would penetrate to a distance of about 6,000 feet down Lagoon be it met the flood from Winyaw Bay.

current and tidal observations just taken it would appear that before this yaw Bay water, assuming that it would follow the Santee ebb back, could reach quito Creek via the United States Canal, it would meet the incoming flood from antee and be returned to Lagoon Creek.

ppose Lagoon Creek was diked off on both sides of the canal, and the canal finished sta. 208+30. Then, from the foregoing, it would seem very probable that the tee flood would reach to the other side of sta. 208+30 toward Winyaw Bay, and d the half-way point from river to bay, and for the same reason as given, the yaw salt water would probably be returned by the Santee flood before it had time ach Mosquito Creek.

aving constructed both dikes at Lagoon Creek, it would not only prevent the salt ter from coming into the canal from the lagoons, but would also restore the gen l conditions of things as they were when Mosquito Creek was open from Santee er to Winyaw Bay. These dikes would give an additional protection to the canal aving it from cross-currents and the probable formation of a troublesome shoal, might be, it is thought, included in the work of the revetment.

ppose the canal was finished to sta. 208+30, and its banks connected at Lagoon k by these dikes, would not these 3 miles of continuous wall, between the low sea-beach and the rice fields near by, be advantageous rather than otherwise to rice planter.

Were both dikes constructed at Lagoon Creek, and a tide lock also needed after ds, I should think that the best place for the location of the lock would then be the vicinity of sta. 208+30, where the Santee and Winyaw waters would probably early in equilibrium; but should you deem a lock necessary and not the dikes, only place to locate it would be just below Lagoon Creek, in the canal.

From what I can understand about the tide lock required, it can be simply con cted of creosoted wood, and arranged so that its gates or wings can be opened and d at will.

The cost of a structure of this description would *possibly* be about as follows, but this rough estimate is liable to change as the matter may be more thoroughly ex ined. The chief cost would likely be in securing the foundations.

The lock to be 35 feet wide in the clear, and 60 feet long, with two sets of gates, and intended only to prevent the tide from flowing through at certain stages.

000 feet of creosoted lumber	$2,000
ping machinery, ten days, at $40	400
work	400
Labor and contingencies	2,000
	4,800

Capt. James Mercur, Corps of Engineers, United States Army, mentions the possible necessity for a lock in the canal, in his report to the Chief of Engineers, United States Army, dated February 2, 1882.

The South Carolina legislature passed an act in January, 1882, of which the following is an extract, which explains itself:

> "A BILL ceding the jurisdiction of the State of South Carolina to the United States of America, over such lands as may be required for connecting Winyaw Bay and Santee River, in Georgetown County, so as to facilitate commerce.
>
> "*Be it enacted by the senate and house of representatives of the State of South Carolina, now met and sitting in general assembly, and by the authority of the same:*
>
> "SECTION 1. That the jurisdiction of the State of South Carolina is hereby ceded to the United States of America over so much land as shall be necessary for the purpose of connecting Winyaw Bay and Santee River, in Georgetown County, so as to facilitate commercial intercourse on the waters thereof, said connection to be provided with a lock or flood-gate to protect the rice plantations which may be affected thereby, if the same may be deemed necessary by the United States Engineer in charge of the improvements."

The rice lands supposed to be in jeopardy from salt water are as follows: A
ment by Mr. R. I'on Lowndes gives the total areas on Mosquito Creek as bein
acres, and he places their value at $50 per acre. A statement by Mr. William
Hazzard gives the acreage, as owned by himself and situated on Minim Creek,
the Santee mouth of Mosquito, at 700 acres. He does not state their value, but
pose it is no more than that as expressed by Mr. Lowndes.

Mr. Lowndes was asked why it was not possible to waste any impure wate
might be in Mosquito Creek at low tide, through his lock on the flood, inasmuch
Santee water rose first and highest. His reply was that he had been in the ha
thus disposing of the bad water, which Mosquito Creek had always been subj
more or less; but he feared that he would be unable to waste any water in exc
that spoken of, because then a sufficient head of water would not be retained
Santee side to properly irrigate his lands.[18]

I would here thank Mr. Lowndes for many courtesies extended to me in my
in complying with your orders in the collection of data for this report. He spar
pains to further me in this work. I respectfully inclose a tabulated statement
nished by him, giving the stages of the water in the Santee, Wateree, Congaree,
Pee Dee rivers, in the up-country, for certain periods, as will be seen by the stat
This may be useful or interesting to you in showing approximately the volu
fresh water the Santee contained during the time when we were keeping a reco
the water in the United States Canal in the year 1884.

Very respectfully, your obedient servant,

Reid Whitford,
Assistant Engine

Capt. W. H. Bixby,
Corps of Engineers, U. S. A.

APPENDIX TO ASSISTANT ENGINEER WHITFORD'S REPORT.

Mr. R. I'on Lowndes, the representative of the persons claiming
tection for their rice interests, came to my office on February 15, 18
to talk over the subject with me. I read him all of Assistant Engin
Whitford's report (except the first few pages, which he had already re
and asked him to comment fully whenever he thought comments nec
sary to fully explain his side of the case. His comments, written
by me and revised by him, are herewith appended. The numbers
respond to numbers inserted by me in Mr. Whitford's report.
Lowndes was several times asked to add more to his remarks,
thought finally that these eighteen comments covered all he needed
add to Mr. Whitford's report in order to make it fully cover his sid
the question.

W. H. Bixby,
Captain of Engineer

[1] Most of this must go into the Santee end of Mosquito Creek and will injure t
rice interests.

[2] Doubted, unless "an easterly" means only one that goes over the original ba
an ordinary easterly blow would not do this.

[3] Not unless it can get through the high banks already put up by the rice intere

[4] This is the value of Mosquito Creek to the rice owners and why these lands
always able to make crops when men higher up the other rivers (not Santee) c
not do so.

[5] But this never happens during the irrigating season.

[6] This was the dirty brackish water unfit for irrigating.

[7] Considerable, instead of very little.

[8] This water, a little brackish, is just as injurious to the rice plantersas very
water.

[9] This is all I claim. Moreover, there was a freshet in the Santee at the times t
observations were taken; in summer, when the water is low, the flow of salt w
from the Government cut will be much increased.

---

* Omitted.

[10] This same centrifugal force acts in a similar way at the Santee end of the canal (where it empties into Mosquito Creek) to hold back the water in Mosquito Creek and prevent the otherwise natural fall of ebb necessary to drain the rice lands in Mosquito Creek above the canal.

[11] But if Winyaw Bay were salt, as it would be during the irrigating months, the water in Lagoon Creek would be salt, and then the salt water from Winyaw would go through Lagoon Creek down the Government cut.

[12] This is true during the flush water season when Winyaw Bay is fresh at low water, but in the irrigating season, when Winyaw is salt at all stages of the tide, the water (then salt) would come from Winyaw into the lagoons, and from them on the ebb tide into the Government Canal and Mosquito Creek, as it comes now, fresh.

[13] In the summer this would not be true, as Winyaw would send as much salt water into Lagoon Creek and the lagoons as it is now sending fresh water; and this would make brackish the water which returns on the ebb from the lagoons into the Government cut and Mosquito Creek.

[14] This should be when the lower part of Mosquito Creek becomes salt on the last portion of the flood.

[15] This difference in the water level (as shown at my flood-gate) cannot be observed at any single point in the Government Canal, because the latter is always open; but it would exist if the Government Canal were closed by a flood-gate at its Lagoon Creek end. While the Government Canal remains open, the effect of this difference of level is to force the impure water of Lagoon Creek on ebb tide into Mosquito Creek, thereby poisoning the water of Mosquito Creek for irrigating purposes, keeping it that much fuller and thereby lessening the fall in said creek and thus impairing the drainage of my lands that lie on the creek, especially above the point where the Government cut enters it.

[16] I would call this to your attention: that my gate (which is a double gate opening both toward the Santee and Winyaw) is so arranged during the whole irrigating season that it automatically opens towards Winyaw to the allow Santee floods to pass, but automatically closes against Winyaw floods to keep them out. During the observations of Mr. Martin in February, 1886, the Santee gates were closed at his request, and consequently the heights on the Winyaw side were not as great as during the usual condition of affairs throughout the irrigating season. Also this: that in summer, when I am irrigating all my fields, say 900 acres, which lie all along on Mosquito Creek and on the canals leading to my gate, the water, while my trunks are open, cannot rise even high enough in the canal to open the gate; and the suction out of Mosquito Creek into my fields is so great that instead of the Santee water on the flood tide rising high enough to go far enough through your Government cut to push back the bad water in Lagoon Creek, the impure water of Lagoon Creek will be drawn by the great suction through your cut into Mosquito Creek or so far into your cut that it will be sure to enter Mosquito Creek on the early part of the following ebb tide. Please mention also that your observations of February 7, as to rise and fall of tides, were taken with all my lands dry and all outside doors to my trunks closed; and that with the usual condition of things during the irrigating season the height of Santee floods in Mosquito Creek would be much lessened, and the amount of fresh water in the creek will be much lessened.

[17] This was when Santee was in freshet, and Winyaw not as high as usual during freshet months.

[18] Moreover this impure water would fill the main irrigation canals (none of which are provided with gates, and for which gates would be inconvenient and costly), and this impure water would then intervene between the fields and the fresh water outside.

I am not seeking indemnity, but only protection against damage, and this protection is needed at once, as the planting season will soon be upon us.

[19] Omitted.

L 13.

IMPROVEMENT OF WATEREE RIVER, SOUTH CAROLINA.

The Wateree River, which unites with the Congaree to form the Santee, has (including its upper portion, called the Catawba) a total length of about 310 miles, and a drainage area of 5,642 square miles. This river, prior to governmental improvement in 1882, had a low-water depth of from 3 to 4 feet from its mouth in the Santee upward 64 miles to Camden, its practical limit of steam navigation. From its mouth upward 12 miles the river was completely blocked at all stages of w by sunken logs and stumps and by floating obstructions; thenc miles to Camden navigation was possible, but dangerous except du high water. Its commerce was then almost nothing.

The original project of 1881–'2, as continued to date, proposed $54,000 to secure a safe and unobstructed 4-foot navigation over t entire distance at all stages of water.

Inadequate yearly appropriations, involving the alternate disorg ganization and reorganization of working parties, damage to unfinis work, extra superintendence, and deterioration of plant, have ad about $4,000 to the cost of the work. The aggregate amount ap propriated for this project up to 20th June, 1886, is $28,000. The pre estimate (that of 1885), $58,000, for the final cost of the work, ba upon the present condition of the river and past experience, agr well with the original estimate.

Twenty-seven thousand nine hundred and sixty-five dollars and six three cents have been spent in all upon this improvement up to 30 June, 1886, giving a thoroughly-cleared 4-foot navigation at all stag of water from the mouth of the river 7 miles upward, and thence roughly-cleared 4-foot navigation over the rest of the river 57 miles Camden. In consequence of this improvement a steamboat line wou have been permanently established upon the whole length of this riv had it not been prevented by the obstructions offered by two railro bridges. Could these obstructions be removed a river commerce $1,000,000 of transported goods per year would be at once develope

The extent of this obstruction is shown by the following extract fr special report, dated 17th January, 1885:

> Eight miles above its mouth in the Santee, this river is crossed by the Cam Branch of the South Carolina Railroad, on a wooden through bridge without a dr span, the bottom of the bridge being 15.3 feet above low water. The use of t bridge without a draw has been specially authorized, as far as concerns the Stat South Carolina, by State acts passed in 1853 and 1858.
>
> Thirteen miles above its mouth the river is also crossed by the Wilmington, Colu bia and Augusta Railroad on a wooden deck bridge without a draw-span, the t ... of the bridge being about 17 feet above low water.
>
> The present improvement will probably be finished next year sufficiently to al of a reasonably clear 4-foot navigation to steamers * * * over the wh river from its mouth up to Camden. The current of this river is swift and stro especially during high water stages. Both bridges have already proved seri obstructions to a desired navigation.
>
> I therefore recommend that the owners of both these bridges be required to ins suitable draw-spans in their bridges; that the spans be at least 60 feet wide in clear; that the opening be placed with reference to deep water and the convenie of navigation; that the openings be provided with strong and suitable fenders both ends of the span, extending, say, 150 feet above and 80 feet below the brid and that these fenders should rise above ordinary high water to within about a f of the draw-span's lower chord.

I would now modify the above recommendations so as to allow t Wilmington, Columbia and Augusta Railroad (if it so chooses) to d pense with a draw by raising its channel-span 21 feet, which can readily done by converting its present deck bridge into a through brid This modification will place the bottom of the bridge 38 feet above lo water.

The special work of the year has been as follows:

Expenditures, $238.46.

Owing to its variable features, and the difficulty of properly speci ing it beforehand and inspecting it afterward, the work was allowa done by hired labor and the purchase of materials in open market.

A small survey of the river was made in June with a view of obtaining a map suitable for properly ordering and recording future work. This survey was very efficiently made by Assistant Engineer Charles Humphreys.

Other than this and office work and the care of the Government property nothing has been done for want of funds.

The general charge of the work has been under the immediate supervision of Assistant Engineer Reid Whitford. His full report (including a brief history of past work upon this improvement) is herewith appended.

Recommendations for future work are as follows:

That this improvement be completed in accordance with the present approved and adopted project, so as to secure a thoroughly-cleared foot navigation over the entire river at all stages of water, at a total expense of $30,000, in addition to the $34.37 available 30th June, 1886, this amount to be appropriated in one sum during the next year. Smaller yearly appropriations will increase the cost of the work by from $1,000 to $4,000 per appropriation.

It is further strongly recommended that the South Carolina Railroad be required to put a draw-span in its low through bridge across the river, and that the Wilmington, Columbia and Augusta Railroad be required to either insert a draw span or to raise its present channel-span feet.

Further improvement, so as to extend the navigation above Camden or to deepen that below Camden, is not recommended.

After the improvement is finished its proper maintenance may cost from $1,000 to $3,000 per year.

This improvement, as regards cost and order of work, should be carried on approximately as follows:

The entire length of river should be examined and improved uniformly each year.

During the low-water stage the most troublesome sunken logs and snags should be removed from the channel.

During the high-water stage the most troublesome leaning trees should be cut down and pulled back from the banks, as also such trees on caving banks as appear liable to fall into the river during the following year.

This river is in the collection district of Georgetown, S. C.

Money statement.

July 1, 1885, amount available		$278 83
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$3 71	
July 1, 1886, outstanding liabilities	234 75	
		238 46
July 1, 1886, amount available		34 37
Amount appropriated by act approved August 5, 1886		7,500 00
Amount available for fiscal year ending June 30, 1887		7,534 37
Amount (estimated) required for completion of existing project		25,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888		25,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

upward 12 miles the rive
by sunken logs and st
miles to Camden naviga
high water. Its comme
The original project
$54,000 to secure a saf
entire distance at all st
Inadequate yearly a
ization and reorganiz
work, extra superinte
about $4,000 to the c
priated for this proje
estimate (that of 188
upon the present co
well with the origina
Twenty-seven thou
three cents have be
June, 1886, giving a
of water from the
roughly-cleared 4-fo
Camden. In conseq
have been permane
had it not been pre
bridges. Could th
$1,000,000 of trans
The extent of th
special report, da

Eight miles abov
Branch of the South
span, the bottom of
bridge without a d
South Carolina, by S
Thirteen miles a
bia and Augusta R
tom of the bridge
The present impr
of a tolerably clea
river from its mou
especially during
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I therefore recom
suitable draw-sp
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and that these
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water.
The spec
Expend
Owing to
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done by h

[illegible] ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., March 11, 18

the following report concerning the Wat
to date:

GENERAL FEATURES.

of the Catawba.
ins, McDowell County, North C
North Carolina Railroad, close to
ppi basins.
through portions of North and So
junction with Wateree Creek, a
upper part of Fairfield County, South C
Camden.
eristic features from the portion called
a misnomer, or at least unnecessary.'
southerly direction for a distance of 105 mil
Santee.
southerly direction for a distance of 184 mile
Atlantic Ocean 8 miles south of Winyaw Bay
the Wateree River draws its supply of wa
of Western North Carolina, and therefor
advantages than many other rivers which do
to secure a constant supply of water.
fertile section of this State, from which th
produce.
that when the river is cleared from obst
of incalculable benefit to the people of its r
to the commerce of the country, thereby a
situated on the river, a town of some 2,50
present the head of navigation.
feet depth of water in the channel from that t
the river.
Company owns and operates a railroad between Ki
other railroad in that immediate vicinity.
transportation to much of the country not in e
beginning on the history of the improvement of
might be of interest to collect some facts dating
river. Through the kindness of Mr. Walter Haz
I have been enabled to collect many interesting f
attempts to improve the navigation of the Cata
improvement was intrusted to the United States G

AND UPPER CATAWBA IMPROVEMENT.

legislature of South Carolina on the 27th day of Ma
consisting of eight men for the opening of the navigat
Carolina. This act authorized these eight men t
in order that the river might be made navigable,
accomplish this either by dams, canals, and locks, o
to the said company to be most fit and convenie
charge boats, rafts, &c., any amount of toll for t
paid 25 per cent. on the invested capital, but it must
company is said§ to have endeavored, with State
this river, but with very little if any success.
United States civil engineer, estimated] the cost and

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his report, page 946, Annual Report of Chief of Engine
his report, page 946, Annual Report Chief of Engine
page 1120, Annual Report Chief of Engineers, 1885.
page 913, Annual Report Chief of Engineers, 1880.
Annual Report Chief of Engineers, 1886.

nt at $2,000,000 for slackwater navigation, the only kind of navigation ap- to the river.

The river and harbor act of March 3, 1879, provided for surveys or exami- of the Upper and Lower Catawba rivers. This work was placed in charge of arles B. Phillips, Corps of Engineers, United States Army, the 12th of May g, and the examination was completed by the next autumn. Captain Phillips t that the Lower Catawba (that portion in South Carolina) was 55 miles in had a total fall of 325 feet; that owing to this great fall its improvement, by a system of locks and dams, would be out of the question; that the cost improvement would be about $50,000 per mile; that inasmuch as its present pective demands of commerce were not sufficient to warrant this expenditure ot consider the work a public necessity, and hence he recommended its (Ca- improvement should not be undertaken.

in Phillips also reported[*] that the Upper Catawba (that portion in North) was 140 miles in length from Old Fort, N. C., where the examination was ced, to where it crosses the State line, and had a total fall in that distance of and that, for reasons similar to those given above for the Catawba, he rec- led that its improvement should not be undertaken.

WATEREE RIVER—HISTORY OF ITS IMPROVEMENT.

On April 21 an act was passed by the general assembly of the Province of arolina providing for the improvement of this river.

an by saying, "Whereas the making of the Wateree River navigable will be benefit to the inhabitants of that part of the Province, and tend to the better nt thereof, we therefore humbly pray His Most Sacred Majesty that it may be ." The act specified the work to be done in the shape of taking away the d other obstructions in said river, &c. It provided means of doing this work ng a tax of 10 shillings on the 100 acres of land lying within 10 miles of the ., owned and claimed by any person or persons who did not reside on the d that all the male inhabitants from the age of sixteen to sixty years living r side of the river, &c., would be obliged to work at removing said obstruc- enever the five commissioners, appointed by this act to look after the work, all on them.[†]

On March 26 an act was passed by the general assembly of the State of South appropriating £300 sterling for the purpose of removing obstructions from r as high up as Camden. Five commissioners were appointed by this act to the work by contract or otherwise have it done, to draw all moneys from the asury, settle all accounts, and have general direction of the whole work.[‡]

n March 24 an act for clearing the Wateree was passed by the general assem no details were given.

An act to establish a company for the opening of the Wateree and Catawba outh Carolina, was passed.[§]

On February 9 an act was passed to open and improve the navigation on the River from the falls near Mr. Chestnut's ferry down to the confluence of the and Congaree.

en were appointed to look after this work, and they were to be known as the ee board of commissioners." The act further provided that all male inhab- tween the ages of sixteen and fifty years, living within 6 miles of said river, &c., de liable to work on the river under direction of said commissioners, for the six days in a year and *no more*.[‖]

On 19th December an act of this date appropriated $2,000 for the improve- the river from Camden Ferry to the Congaree River. This act appointed seven commissioners to look after the work and make yearly reports to the comp- general explaining the progress made with the improvement, &c.[¶]

On March 3 the river and harbor act passed by the Congress of the United rovided for an examination or survey of the Wateree River. This work was n the charge of Captain Phillips the 12th of May following, and the examina- the river from Wateree Creek to its mouth was completed by Assistant Engi- lbrect as soon as he had finished with the similar examinations of the Ca- heretofore mentioned. Mr. Walbrect said that there were two railroad across the river which would have to be converted into draw-bridges if the ment was ordered.

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[*] See page 911, Annual Report Chief of Engineers, 1880.

[†] See Statutes at Large of South Carolina, vol. vii, page 504.

[‡] See Statutes at Large of South Carolina, vol. vii, page 532.

[§] See under head of "Lower Catawba," this report, for fuller details.

[‖] See Statutes at Large of South Carolina, vol. vii, page 562.

[¶] See Statutes at Large of South Carolina, vol. vii, page 578.

REPORT OF MR. REID WHITF [illegible]

CAPTAIN: I have the honor to make the [illegible]
River, South Carolina, for fiscal year to da [illegible]

GENERAL [illegible]

The Wateree River is merely a continu [illegible]
The latter river heads in the Blue Ridge [illegible]
lina, near the Swananoa tunnel on the W [illegible]
main divide between the Atlantic and M [illegible]
It runs thence first easterly, then sou [illegible]
Carolina, and takes the name "Wateree" [illegible]
tributary entering from the west in the [illegible]
lina, some distance above the town of C [illegible]
The Wateree River derives all its cha [illegible]
Catawba, and the name of Wateree is [illegible]
The Wateree after flowing on in a [illegible]
unites with Congaree and forms the S [illegible]
This latter river continues on in a [illegible]
and then empties its waters into the A [illegible]
From the above it will be seen that [illegible]
direct from the mountains and sprin [illegible]
should possess greater navigable adv [illegible]
reach sufficiently near the main divi [illegible]
The Wateree drains an exceeding [illegible]
is shipped yearly a large amount of [illegible]
There seems to be but little doubt [illegible]
tions and open for traffic it will be [illegible]
basin and at once give strong imp [illegible]
ing greatly to its prosperity. Cam [illegible]
3,000 inhabitants, is considered at [illegible]
There is probably not less than [illegible]
to the ocean at the lower stages of [illegible]
The South Carolina Railroad Co [illegible]
ville and Camden. There is no o [illegible]
The river will furnish means o [illegible]
reach of the railroad.
I would here state, before be [illegible]
Wateree River, that I thought it [illegible]
into the past in reference to this [illegible]
a prominent lawyer of this place [illegible]
as to the various and thorough [illegible]
and Wateree rivers before their [illegible]
ernment engineers.

HISTORY OF LOW [illegible]

1787. An act passed by the [illegible]
1787, established a company co [illegible]
of the Catawba River, South [illegible]
just about what they wished [illegible]
further said that they might [illegible]
any other manner which seem [illegible]
and further, that they migh [illegible]
passage till the dividends p [illegible]
exceed these figures.
Previous to the year 182 [illegible]
to improve the navigation [illegible]
1875. Col. S. T. Abert, U [illegible]

[illegible] miles of
[illegible] and had a to
[illegible] light-draugh
[illegible], and he su
[illegible] removing ob
[illegible] secure a local c
[illegible] for an exam
[illegible] This work was a
[illegible] field work was in
[illegible] and finished it i
[illegible] ovement of the
[illegible] of 4 feet in a
[illegible] ting logs and
[illegible] was approved an
[illegible] work. Capt. Jam
[illegible] of this work Jun
[illegible] approved was con
[illegible] A steam hoiste
[illegible] confined to that por
[illegible] Railroad Bridge,
[illegible] was entirely disabled
[illegible] available for work,
[illegible] the river banks betw
[illegible] statement of work
[illegible] mentioned. The riv
[illegible], and that simply the
[illegible] railroad bridge, and
[illegible] to be done on that sec
[illegible] railroad bridges across the
[illegible] stacks, &c.
[illegible] appropriated $15,000 for
[illegible] the existing project. At t
[illegible] because of the exhaustion
[illegible] resumed till 1883, in M
[illegible] worked from 5th of May
[illegible] completing that portion
[illegible] examination to Camden, and
[illegible] some of the obstructi
[illegible] things it was report
[illegible] between Camden and th
[illegible] which crossed this river 5
[illegible] but the boat having met
[illegible] removed and sold.§
[illegible] ion of Captain Mercur
[illegible] Hinman, Corps of Engineers.
[illegible] stopped on March 23, 188
[illegible] work was carried on by H. Het
[illegible] year was reported‖ as done be
[illegible] Congaree, a distance of probab
[illegible] reported as effectually clea
[illegible]. A little work was also do
[illegible] junction with the Congaree.
[illegible] taken from the bed of th
[illegible] the banks.
[illegible] 1884, appropriated $5,000 fo
[illegible] in local charge of the work
[illegible] Hinman was succeeded by Cap
[illegible] Army, in 1884. Under this new ap
[illegible] 7th November, 1884, and con
[illegible] of April, 1885, when the ava
[illegible] more suspended. During t

---

*See Captain Phillips in [illegible]
1880.
†See Captain Phillips [illegible]
1880.
‡Captain Bixby's repo [illegible]
§Report W. A. Walk [illegible]
‖See Abert, page 367, [illegible]

[illegible] Engineers for 1880, page 915.
[illegible] Engineers for 1881, page 1034.
[illegible] Engineers for 1882, page 1111.
[illegible] Report for 1883, page 871.
[illegible] Report for 1884, page 1051.

obstructions from where the machine began to a point ured from this place to Camden, its head of naviga- total of 297 (in all since 1882) logs, large and small, 63 of snags, and 2,533 square yards of rafts or floating ma- of the river, and 385 overhanging trees were cut and During the low-water season of 1884 40 inexpensive water ween the mouth of the river and Camden, and the dead at each. The railroad bridges across the river prevented as soon as was desirable. Special attention was again which these bridges offered to the river navigation,* and it that their owners be required to supply them with suitable dance with already approved and adopted project, an expen- mmended for the completion of the work to Camden.‡

no work done on this stream since June 1, 1885.

ive view of the foregoing it will be seen that the improve- been carried on at intervals, so far, from the year 1753 to 1888, one hundred and thirty-five years, under different appropria- , as follows:

government of South Carolina levying a special local tax on of the local inhabitants thereof.
overnment of South Carolina appropriating 300 pounds sterling.
government of South Carolina an ordinance (details not given).
government of South Carolina establishing a company.
te government of South Carolina, local inhabitants performing labor.
ate government of South Carolina appropriating $2,000.
overnment of the United States appropriating $8,000.
overnment of the United States appropriating $15,000.
overnment of the United States appropriating $5,000.

distances, &c., are summed up from reports of Captain Phillips, Engineer, except the first therein, which was taken from postal map of :

	Miles.
awba River from its head to Old Fort (fall not given)............	10
atawba River from Old Fort to North Carolina line (total fall 890	140
atawba River from North Carolina line to Wateree River (total fall	55
ateree River from Wateree Creek to Camden (fall not given)......	41
Vateree River from Camden to Congaree and Santee (fall not given).	64
antee River from its head to the ocean	184
length	494

RECOMMENDATIONS FOR NEXT SEASON'S WORK.

espectfully offer for your consideration the following recommendations for s work.

the difficulty of properly classifying the work, that it be done by hired la- hinery. To this end it is thought from past experience that it is important ters employed upon this river to be self-propelling and capable of steam- 1½ miles per hour against the current in the river.

rule the removal of obstructions from the bed of the river should be done ow water or when the water is not over 3 feet above its dead low stage. xception rafts and floating material should be taken out at all stages of e removal of them is quite as essential as the removal of obstructions from he river, because if not attended to these rafts soon accumulate to such to form perfect jams from bottom of river to surface of water.

cutting of growth from banks be done when the water is too high for other hat when possible the trees should be taken up with their roots by blast- ing away the earth with jets of water discharged through pipes by strong , so that no stumps will be left projecting to fall in the channel as the nue to erode under action of the current. I should think that it would onduct operations by working from the mouth of the river to Camden, re- most troublesome obstructions, then work back, widening and improving , and so on back and forth till the work was completed.

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rt of Captain Bixby to Chief of Engineers, dated January 17, 1885.
ual Report Chief of Engineers, year 1885.
f Captain Bixby to Chief of Engineers for 1885.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] Commissioners of
[illegible] which were
[illegible] navig
[illegible]

[illegible] was built at Prince Edward Island
She was a wooden vessel, of [illegible] feet in length, 25 feet beam, a
depth. This vessel was loaded at Wilmington about the year
was wrecked on the [illegible] of Oak Island Channel, at the mou
river, 19 miles below Wilmington. After the cargo was taken
drifted back into the river, burnt to the water's edge, and s
point about a half mile above the Price's Creek light-house an
the western side of Snow's Marsh Channel. In February,
wreck lay in from 11 to 13 feet depth of water. Portions of t
rose to within 4 feet of the water surface and other portions d
to probably 16, but possibly 20, feet below the water surface.

The side wheel steamer North Heath was a blockade-runn
the late war. At or about the time of the capture of Fort
1865, she was taken by the Confederate authorities and sunk in
channel of the river, near the head of Clark's Island, about 3
low Wilmington, as an obstruction to navigation. She was an
wheel light draught steamer of from 200 to 250 feet in length.
per works were above the water surface for several years, and
tain parties, by the use of explosives, removed as much of the
was profitable to them and left the remainder. In February,
wreck lay in from 17 to 20 feet depth of water. Portions of t
rose to within 7 feet of the water surface and other portions d
to 23 feet below the water surface.

The natural bottom in both places was mud, but the accum
sand was to be expected around the wrecks.

There was probably nothing about either wreck of any value
saving.

cordance with the provisions of section 4 of the act of 14th June, hirty days' notice was given to all persons interested in these ; and in default of the appearance of any such persons, the re of these wrecks was duly advertised. Proposals were opened 7th 1886, and a contract with the lowest bidder, the American Dredg mpany, was approved on the 23d June, they agreeing for $7,500 pletely remove the wrecks within four months from the signing contracts.

e were no expenditures for this work prior to 30th June, 1886.

k will probably commence promptly in July.

provisions of section 4 of the act of the 14th June, 1880, require n all such cases of the removal of such wrecks "all property when so removed shall, after reasonable notice of the time and of sale, be sold to the highest bidder or bidders for cash, and the ds of such sale shall be deposited in the Treasury of the United to the credit of a fund for the removal of such obstructions to tion, under the direction of the Secretary of War." In this par case there is probably hardly anything about either wreck that ll for the amount of money that its removal will cost the con . Under such circumstances, the contractor will be obliged to rge amount of otherwise unnecessary labor in landing this prop nd as his bid was of course based on the necessity of performing herwise unnecessary labor, the Government will, in the end, have r the property much more than it will have received, and will loser by the whole operation.

satisfied that in this particular case the proposals would have uch lower and the final cost of removal of the wrecks much less Government could the wreck have become the property of the ctor after its removal. I have therefore to recommend that the the 14th of June, 1880, be so modified as to allow the Secretary r, before advertising the removal of the wreck, to decide whether the property when removed shall belong to the contractor or to vernment. In my opinion some such modification would result omy to the Government.

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of proposals for removing wrecks of brig Clio and steamer North Heath from Cape River, North Carolina, opened June 7, 1886, by Capt. W. H. Bixby, Corps of En s, United States Army.

Names and addresses.	Price bid (total sum).
liam E. Chapman, Brooklyn, N. Y	$9,970
P. Bowdoin, Wilmington, N. C	16,000
nhouse Moore, Mobile, Ala	10,987
erican Dredging Company, Philadelphia, Pa	7,500

act awarded to American Dredging Company.

APPENDIX M.

PROVEMENT OF RIVERS AND HARBORS ON THE COAST OF SOUTH CAROLINA AND GEORGIA, AND PART OF THE ATLANTIC COAST OF FLORIDA.

PORT OF COLONEL Q. A. GILLMORE, CORPS OF ENGINEERS, BVT. MAJ. GEN. U. S. A., OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

Charleston Harbor, South Carolina.
Wappoo Cut, South Carolina.
Ashley River, South Carolina.
disto River, South Carolina.
alkiehatchie River, South Carolina.
avannah Harbor and River, Georgia.
avannah River, Georgia.
avannah River above Augusta, Ga.
9. **Saint Augustine Creek (Thunderbolt River), Georgia.**
10. **Romerly Marsh, Georgia.**
11. **Altamaha River, Georgia.**
12. **Brunswick Harbor, Georgia.**
13. **Entrance to Cumberland Sound, Georgia and Florida.**
14. **Inside passage between Fernandina and Saint John's River, Florida.**

UNITED STATES ENGINEER OFFICE,
New York, July 31, 1886.

GENERAL: I have the honor to transmit herewith my annual reports pon the works of river and harbor improvement under my charge for e fiscal year ending June 30, 1886.

Very respectfully, your obedient servant,

Q. A. GILLMORE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

M 1.

MPROVEMENT OF THE HARBOR AT CHARLESTON, INCLUDING SULLIVAN'S ISLAND, SOUTH CAROLINA.

During the fiscal year ending June 30, 1886, operations for improving he entrance into Charleston Harbor, South Carolina, were carried on conformity to the plan submitted in my communication to the Chief f Engineers, dated March 9, 1878, and printed as Appendix H of the nnual Report of the Chief of Engineers, 1878.

By this project it is designed to establish and maintain by mean two jetties a low-water channel of not less than 21 feet depth across bar, upon which the greatest available depth has heretofore been 11½ feet. The estimated cost of the project was $3,000,000.

Previous to the spring of 1878 there had been expended by the G eral Government in the improvement of the ship-channels in Char ton Harbor, subsequent to the close of the civil war (from 1871 to 18 the sum of $93,700 in taking up the wrecks of fourteen iron-clad wooden vessels sunk during the war, and in removing a portion of Bowman Jetty projecting into Beach Channel.

RECAPITULATION OF OPERATIONS PREVIOUS TO JUNE, 1885.

North jetty.—This work was commenced in December, 1878. June 30, 1885, the seaward end of the bottom course of the jetty reached a point 14,327 feet from the starting point on Sullivan's Isl measured along the axis of the work. No work had been done u this jetty since November, 1881.

The width of this bottom course varied from 43 feet at shore to feet at the sea end, and its height from 2½ to 4 feet. A second co of mattresses, varying from 66 feet to 81 feet in width, was laid over bottom course for a length of 1,648 feet from a point about 7,000 from Sullivan's Island seaward, the height of this portion of the j being thereby increased to 5½ or 6 feet. The gaps formerly left Drunken Dick Shoal was closed by a foundation course of 1,663 in length, 64 feet in width, and 3¾ feet to 4 feet in height. South that shoal the jetty was raised by distributing riprap-stone over it. some places the height thus attained was from 13 to 14 feet from bottom.

Up to June 30, 1885, the aggregate amount of riprap-stone plac upon the north jetty was 93,902 cubic yards. The mattress work, of average thickness of 18 inches, composed of logs and brush, amount to 144,077 square yards.

South jetty.—This work was commenced in April, 1880. On June 3 1885, the bottom course extended to a point 15,884 feet from the origin starting point on the shore of Morris Island, or 16,397 feet from hig water mark of June 30, 1884, to which point the jetty was extende about three years ago as a precaution to prevent the sea from cuttin around the original end of the foundation course. The seaward end that course had reached a point beyond the last shoal upon the crest the bar, resting in a depth of 8 feet at mean low water. This poi was about 2,400 feet from the 18-foot low-water curve of the outer slop of the bar.

The jetty after passing the shoal water along the eastern coast Morris Island crosses the existing main ship-channel, which runs abo parallel to the shore of the island, with a maximum depth in the im mediate vicinity of the work of nearly 40 feet at mean low water; furthe east it crosses a deep pocket with low-water depths of from 18 to 2 feet.

From its starting point on Morris Island the jetty is laid upon straight course, bearing south 87 degrees, east for a length of abo 8,660 feet. Thence the axis of the work is laid on chords of about 4 feet length each, corresponding to a circular arc of about 1⅞ miles radiu until it reaches a point 2,900 feet from the straight seaward portion the north jetty. From this point a straight course tangential to th curve and parallel to the straight portion of the north jetty is followe for a length of 2,288 feet.

foundation course consists of log-and-brush mattresses overlaid
riprap stone, as described in former reports. The layer of stone
from 12 to 14 inches in thickness; the mattresses average 18
s in thickness.

a continuous length of somewhat over 3,000 feet, beginning at the
end, the width of the mattresses varies from 40 to 42 feet. On the
reach of about 4,000 feet the width gradually increases from 42 to
et, and the latter width has been maintained to the seaward end
work, with the exception of a number of mattresses of 130 feet
, which were introduced at intervals, projecting from 6 to 15 feet
her side of the regular foundation course. The projecting portions
intended to act as short spurs. This arrangement commences at
it about 8,000 feet from the present shore-end of the jetty and ex-
2,600 feet seaward.

a further provision against scour, more or less parallel to the axis
jetty, which developed while the latter gradually approached the
of the bar, the foundation-courses of longer spurs were distributed
the work, beginning at a point about 11,000 feet from the shore-
nd extending 2,900 feet seaward. These spurs were arranged in
on opposite sides of the main or central bottom course, projecting
100 feet beyond the corresponding edge of said course. The
ations of fifteen pairs of such spur-jetties were laid, placed about
et from center to center.

ere the jetty crosses the present main ship-channel, at which place
ork will ultimately have a considerable height, the original width of
undation-course was increased to from 135 feet to 205 feet by lay-
n apron of log-and-brush mattresses, covered with from 12 to 18
s of stone, along the south edge of the course. This widening be-
at a point 5,360 feet from the present shore-end, and extends a
h of 1,570 feet seaward.

econd course of mattresses, overlaid with riprap-stone, was placed
portions of the bottom course. This second course was not con-
us, but was laid in four detached sections of an aggregate length
,586 feet.

e section nearest to Morris Island commences at the original shore-
It is composed of mattresses 40 feet wide, with 24 inches of stone,
xtends seaward 446 feet.

e next section, 40 to 50 feet in width, with from 12 to 16 inches of
, was laid for a length of 1,554 feet, where the jetty crosses the
ship-channel, beginning at a point 5,360 feet distant from the high-
line on shore.

third section, 44 to 50 feet wide, with 18 inches of stone, was
d from a point 7,047 feet from shore to a point 9,019 feet out a
h of 1,972 feet.

ourth section, formed of mattresses 50 to 55 feet wide, with from
17 inches of stone, extends seaward 6,614 feet from a point about
feet from the present shore-end, and reaches to within less than
et of the outer end of the bottom course.

dging on the bar.—Dredging between the jetties was commenced
20, 1885, on a range about coincident with the line of the greatest
produced by the jetties; 8,929 cubic yards of materiel, consisting
nd and fine, light shells, had been removed at the close of that
year.

veys.—A large amount of field work has been necessary in con-
n with carrying out the project for improving the entrance to
eston Harbor. Special examinations, including borings and cur-

By
two
bar.
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er.
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jetties were required, and since
surveys of the outer ha
harbor, have been made
adopted over five years
surveys.
been done here during the last
sea-shore of the island.
consisting of log-rafts covered
on the beach 3,050 feet east of
shore-end of the north jetty, un
work 288 feet in length, 1,750
ructed in September, 1881, with fu
r improving Charleston Harbor.
situated in the bight formed by
city of Charleston.
June 30, 1885, two spur-dikes were b
washing away of the shore-line, wh
years. One, 477 feet in length, is
east of the ferry-boat wharf; the other,
ver down. The sum of $5,000, expen
in the appropriation made July 5, 18
Harbor. They form only part of a plan
of shore referred to. It is not, howev
any proper sense constitutes an integ
for improving the harbor approved and

THE FISCAL YEAR ENDING JUNE 30, 1886

of $97,267.92 was available for continu
work upon the jetties and dredging betw
continued under the contracts of which the
annual report.
beginning of the fiscal year it became appar
to reduce as much as possible the volume
across the jetty in order to promote the ex
dredged across Swash Reef, a shoal project
ard part of the south jetty to about midway

a second course of mattresses, 55 feet wi
riprap-stone, was laid over the foundation-cour
seaward from a point 11,090 feet from the shore
sured along the axis of the work.
gaining height more rapidly where it would pro
results a ridge or longitudinal pile of riprap-sto
existing work along the center line of the jet
93 feet from the shore and carried seaward
4,485 feet, embracing parts of both the curv
of the jetty, and covering all the second-cou
fiscal year and portions of the bottom course la
outer end of this ridge reaches to within abo
seaward end of the bottom course. It was
nominally of 5 feet average height in the ce
side slopes.
and ridge-work constructed during the pa
height of the north jetty was raised along

r a length of 4,485 feet, from about 3½ feet, which it previously o about 8½ feet; but this height was subsequently reduced, the being gradually leveled down by the action of the waves.

the end of the fiscal year the seaward end of the jetty was 1,200 ithin the outer 18-foot curve of the bar, measured along the pro- tion of the axis of the work.

material expended on this jetty during the year amounted to square yards of log-and-brush mattresses and 7,593 cubic yards ap-stone.

n the beginning of operations to June 30, 1886, 156,078 square of mattresses and 101,495 cubic yards of riprap-stone have been

th jetty.—The foundation-course was extended 43 feet seaward g the first month of the fiscal year. Work was then discontinued this course, as it was not apparent that further extension at that ould produce as beneficial results as work that could be done at points of the jetty.

ird course of mattresses, 44 feet in width, was next placed upon ection of the second course which was laid about two and a half ago, over the foundation course where it crosses the deep pocket f the main ship channel. This work was required to fill up to xtent the depression that here existed in the crest-line of the jetty, diminish the very large volume of water flowing southward along r parts of the structure during ebb-tide. The currents here being trong, the mattresses received a covering of stone of an average ess of 16 inches.

third course commences at a point 7,986 feet from the shore-end jetty, and extends 1,206 feet seaward.

xpedite the confinement of the currents between the seaward f the two jetties, it was decided to expend the balance of funds ning on hand for jetty work, in September, in building a ridge ot stone along the center line of the jetty upon work already laid. ater height could be secured in this way with the same amount of y than by the slower though more substantial process of building r courses of broad log and brush mattresses and riprap stone.

ridge was similar to that built on the north jetty, except that minal height of its crest-line was but 4.6 feet. Its inner end is dent with that of the third course just described. It rests upon that as far as the latter was built, and extends seaward by a continu- ngth of 6,038 feet, reaching to a point about 2,400 feet inside of esent seaward end of the foundation course of the south jetty.

une, 1885, before the third course and the ridge of stone over it een built, the low-water depths over the top of the work averaged t. In June, 1886, the depths had been reduced to 10 feet. The t of the ridge of stone had in the mean time been diminished by tion of the waves; otherwise the reduction of depth would have reater.

m the outer end of the third course to the furthest seaward point ch the ridge has been constructed, a length of over nine-tenths of , the original low-water depths before any work had been done between 9 and 18 feet, averaging 14.6 feet. In June, 1885, the of water over this section averaged 8 feet, while in June, 1886, erage depth was 5.4 feet, taken along the highest part of the work. and near the seaward end of the ridge its crest is bare at low tide, r a considerable distance back there are but a few feet of water . At the end of the fiscal year the seaward end was 2,500 feet from the outer 12-foot curve of the bar, measured in the prolongation of th of the jetty.

The ridge work of the south jetty formed the concluding opera upon the jetties during the fiscal year. The contract with Mr. [illegible] was terminated January 19, 1886. From July 1, 1885, t the named date the contractor put 6,288 square yards of mattresse [illegible] cubic yards of stone in his work on the south jetty. From the beginning of operations to the present time there have been used in constructing the south jetty 287,038 square yards of mattresses and 12 cubic yards of riprap-stone.

Summary of work done on both jetties from beginning of operations to June 30, 18

North jetty:	
Length of bottom course from Sullivan's Island	1
Length of second course, mattresses and stone	1
Length of ridge work, all stone	4
South jetty:	
Length of bottom course from high-water mark on Morris Island	1
Length of second course, mattresses and stone	10
Length of third course, mattresses and stone	1
Length of ridge work, all stone	6

The material used in the work on both jetties aggregated 443, square yards of log and brush mattresses, averaging 18 inches in th ness, and 225,642 cubic yards of stone, equivalent in weight to a [illegible] gross tons.

Dredging on the bar.—Dredging between the jetties was carried on u the range adopted when the work was commenced in May, 1885. range runs nearly but not quite parallel to the straight seaward porti of the jetties, and is located about 1,000 feet from the south jetty. was selected as being approximately upon the line on which the str ebb currents had recently developed more distinctly their scou effects, and as forming a suitable and comparatively short connec between the 18-foot low-water curves of the inner and outer slope the bar. It was not expected that a through cut of that depth c be obtained with the funds then available, but it was proposed to cr a channel of as uniform and great a depth as possible, with the expectation that a through cut, even of inferior depth, would prove in guiding the currents in a proper direction.

The more troublesome part of the work was presented by the no easterly end of the spit known as Swash Reef, which was crossed the line of dredging for a distance of about 1,000 feet with a minin low-water depth of 7.7 feet. This shoal could not be avoided wit adopting another line with somewhat better depths but consider longer between the inner and outer curves to be joined.

The cut passed also through the westerly and deeper part of " [illegible] Shoal," which, starting from a point of the north jetty about [illegible] of a mile from its seaward end, runs east and west half-way ac the space between the two jetties. Its width was about 75 feet an least depth 11 feet at mean low water.

The material raised by the dredging machines was nowhere foun to be of such a nature that it could not be lifted readily, or, when sin [illegible] taken up by the currents developed during the latter stag strong ebb tides. With regard to the latter point we need not except a sort of deposit of comparatively large sized, but broken s with but little sand, met with in the relatively deeper water betw [illegible] Shoal and Swash Reef. This material formed no obs hatever to the suction power of the dredge, and it is anticipated t can easily be moved and carried out by the concentrated cur- as soon as the knoll which Swash Reef forms between this de- nd the deeper water beyond the crest of the bar shall have been ntly lowered.

sh Reef and Jim Evans Shoal, where traversed by the line of ing, were found to be composed of rather coarse sand mixed with ous small or greatly comminuted larger shells, while on the outer of Swash Reef and of the bar the material consisted almost en- of very fine, light gray sand, with traces only of extremely dimin- fragments of small shells.

n the experience gained during the recent dredging operations, hought that the sea bottom of the area comprised between the , where it is designed to locate the new channel, presents no dif- s to its establishment and maintenance whenever the necessary tration of currents shall have been permanently secured.

n July 1 to December 31, 1885, when the contract was terminated, cubic yards of material were excavated, making a total of 85,549 yards removed under the contract.

TION AND EFFECTS OF THE WORKS AND CHANGES IN THE HARBOR AND ON THE BAR.

north and south jetties.—Portions of the north jetty, located on en Dick Shoal, about 6,000 feet from the shore end, are nearly in sand which has accumulated. Some settlement could be noted hort distance only in the vicinity. Near and at the seaward end jetty the work seems to be a good deal broken up. The depths of here have generally increased since this part of the apron was The stone ridge work placed upon the seaward portion of the luring the last fiscal year was, at the end of that period, found about 2 feet in height on an average, it having been leveled down action of the waves.

extreme shore end of the south jetty settled some 2 feet, and a erable quantity of stone was washed off it during the cyclone of st 25, 1885, which caused so much destruction to the buildings and es of the city of Charleston. Otherwise the jetties seems to have d injury. Where the south jetty crosses the deep pocket east existing main ship-channel, from 7,000 to 9,000 feet from shore, con- ble scour has developed on the southern side of the apron, due to erpour of the ebb tide, the currents of which cross the work nearly t angles. A sort of trench is thus formed beyond the ends of gs of the mattresses, which at the point of greatest scour is about et wide and 13 feet below the original bottom. Although a care- amination has failed to show that the jetty has settled at this it is evident that precautionary measures should be taken here n as possible. The outer portion of the jetty for a length of about feet has settled from 1 to 3 feet; the greatest settling has taken at the extreme end, where breakers prevail. The ridge of riprap deposited during the past fiscal year has been levelled down as case of the north jetty. At extreme low water some of the work he outer end of the south jetty is exposed to view. The stone to be tolerably well distributed over the mattresses, but no signs growth of shell-fish, barnacles, &c., to the rock were discovered. ed logs show traces of the work of the teredo.

[illegible] in June last over the crest
[illegible] furnished data for revised app
[illegible] a comparison between the presen
[illegible] and its ultimate condition as requ

[illegible] submitted:

NORTH JETTY.

[illegible] depths over present length of 14,327 *feet.*

[illegible] ....square feet.. 1
[illegible] ....feet..
[illegible] ....square feet..
[illegible] ....feet..
[illegible] project, area ....square feet..
[illegible] ....feet..

Heights of work.

[illegible] according to project ....feet..
[illegible] 30, 1886 ....do....
[illegible] to the jetty ....do....

[illegible] water-way at high tide; mean rise and fall of tides, 5.1 *feet.*

[illegible] over original sea bottom ....square feet.. 2
[illegible] across the work on June 30, 1886 ....do.... 1
[illegible] after completion of project ....do....

[illegible] of water-way equals 46½ per cent. of ultimate contracti

SOUTH JETTY.

[illegible] areas and depths over present length of 16,440 *feet.*

[illegible] sea bottom, area ....square feet.. 2
[illegible] ....feet..
[illegible] 1886, area ....square feet.. 1
[illegible] ....feet..
[illegible] required by project, area ....square feet..
[illegible] ....feet..

Height of work.

[illegible] height required according to project ....feet..
[illegible] height on June 30, 1886 ....do....
[illegible] to be added to the jetty ....do....

[illegible] of water-way at high tide; mean rise and fall of tides, 5.1 *feet.*

[illegible] south jetty over original sea bottom ....square feet.. 3
[illegible] water-way across the work on June 30, 1886 ....do.... 2
[illegible] to exist after completing the project ....do.... 1

Present contraction of water-way equals 53 per cent. of ultimat
[illegible] required.

These results show that a large amount of work is still requir
[illegible] the water-ways by raising both jetties to a higher lev
[illegible] to secure such a concentration of the ebb currents betwee
[illegible] will produce scour of sufficient strength to create or to
[illegible] the proposed new channel and to maintain it.

SWASH CHANNEL* AND THE BAR.

Evans Shoal has not materially changed in size within the 9-foot
ter curve during the past year, but the portion joining the north
as narrowed and pushed seaward. The shoal reaches in a south-
ly direction about two-thirds of the way across the space between
ties.
sh Reef, with its base on the south jetty near its outer end, ex-
in a northeasterly direction about one-third of the way toward
rth jetty; its area confined within the 9-foot curve has been re-
about one-half compared with that of the preceding fiscal year.
cut formed by dredging across the northern end of Swash Reef
oaled in some parts and deepened in others. The examination
t the end of the past fiscal year has shown that at points where the
st water was found previous to dredging the depth was increased
t. It is clear, not only that in order to secure more satisfac-
sults, a much more powerful dredging apparatus, aided possibly
aping and plowing, with a corresponding allotment of funds for
ng it, must be employed, but that the work on the jetties must
e vigorously pushed, so that the more concentrated currents be-
them may have sufficient strength to keep the dredged cuts open.
examination has been made during the past fiscal year of the
, Pumpkin Hill, or South channels. It is to be noted, however,
'umpkin Hill Channel, which for a number of years was the bar-
el proper by which vessels reached the main ship-channel, has
n disuse for a few months past. The channel at present used is
ally a southerly prolongation of the main ship-channel. In ap-
ing from the sea the sailing line crosses the outer 18-foot curve
bar at a point about 3 miles southeast of the mouth of Light-
Inlet, and runs nearly due north until it enters the main channel.
ave in former reports insisted upon the necessity of larger ap-
iations to insure a decided improvement of the channel between
tties before the deterioration of Pumpkin Hill Channel should
ss too far. The reopening of the old South Channel at the pres-
ncture is fortunate, as from its greater distance from the jetties
be comparatively more secure from their influence as long as op-
ns remain suspended, but it is nevertheless true that efforts should
le to open the proposed new channel with superior depths as soon
cticable.
ated in my last annual report that the funds set apart from the
vailable appropriation for dredging, about $28,000, could not be
ed to produce very decisive results even in conjunction with the ex-
jetties, although it would doubtless have a tendency to secure bet-
ection as well as a greater concentration of ebb currents through
w channel, but that the improvement that might be effected by
ng would be partially and perhaps wholly lost by the unavoid-
uspension of operations. This anticipation has proved correct.
urvey made in June last, six months after dredging had to be
d, showed hardly a trace of the dredged cut, and only some in-
of depth on the shallowest part of Swash Reef, where dredging
en done, could be recorded. I have no doubt that if funds had
vailable for continuing the work without intermission, very sat-
ry results could have been reported at the end of the fiscal year.
ivan's Island.—The beach of Sullivan's Island has continued to
lown at and to the west of Bowman's Jetty, and some work of pro-

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* The Swash Channel is the one between the jetties.

tection may be required here shortly. East of said jetty the beach changed but little.

Morris Island.—The cutting away of the north end of Morris Isl has continued, and in a slighter degree the beach has washed dow the vicinity of the south jetty.

Mount Pleasant.—The two spurs built in 1884 for protecting that j of the shore-line of Mount Pleasant situated southeast of the ferry-l wharf are in good condition. Sand has collected at their inner e No marked change in the high-water line has been observed, but at s points the bluff is still caving.

Inner Harbor.—No examination was made of Hog Island Channel d ing the past fiscal year. As I stated in my last annual report, its in end or entrance has constantly increased in width for more than si years, and as the increasing volume of water diverted toward the ch nel cannot fail to have a detrimental influence upon the deep-water a in front of the city wharves, while it is probably the cause of the croachment upon the shore-line of Mount Pleasant, it is desirable th suitable works should be built to prevent further enlargement of entrance. I do not recommend, however, the diversion for that purp of any funds which may be appropriated for improving the entrance the harbor.

During the cyclone of August 25, 1885, a bark, which had been wreck a year before at the mouth of the Ship-Yard Creek where it enters To Creek, near the upper end of the city of Charleston, was drifted into position to obstruct the channel of navigation in that creek. The D partment authorized the removal of the wreck, in accordance with t provisions of section 4 of the river and harbor act of June 14, 18 Proposals for doing this were advertised for and received, but were jected on account of the excessive prices asked; and under authority the Department the work was successfully and economically perform by the use of the United States snag-boat Toccoa, which was put commission temporarily for the purpose. My report on the subject w forwarded to the Chief of Engineers under date of January 27, 1886.

With the funds next appropriated portions of both jetties will raised to greater heights, and the work of dredging between their se ward ends may be resumed if the appropriation is adequate for bo purposes.

This work is located in the collection district of Charleston, S. C., at the port entry. Amount of duties collected in the calendar year 1885, $32,741.63.

Since the existing plan of improvement was adopted the followi appropriations have been made:

By act of Congress approved June 18, 1878	$200,
By act of Congress approved March 3, 1879	200,
By act of Congress approved June 14, 1880	170,
By act of Congress approved March 3, 1881	175,
By act of Congress passed August 2, 1882	300,
By act of Congress approved July 5, 1884	250,
Total	1,295,

Of this amount there has been expended from the beginning of ope ations to June 30, 1886, the aggregate sum of $1,294,945.

Balance yet to be appropriated on the original maximum estima $1,712,500.

The following drawings and papers accompany this report:

Sheet I. Chart showing the sites of the north and south jetties, the progress made their construction to June 30, 1886, and the present depths on the bar.

I. Showing section of the north jetty and a plan of the mattress at various
built to June 30, 1886.
II. Showing section of the south jetty and a plan of the mattress at various
built to June 30, 1886.
of First Lieut. Frederic V. Abbot, Corps of Engineers.
f commercial statistics furnished by the collector of the port.

Money statement.

85, amount available..		$97,267 92
86, amount expended during fiscal year, exclusive lities outstanding July 1, 1885	$97,156 73	
86, outstanding liabilities..........................	56 19	
		97,212 92
86, amount available		55 00
ppropriated by act approved August 5, 1886		187,500 00
vailable for fiscal year ending June 30, 1887..................		187,555 00
(estimated) required for completion of existing project......		1,525,000 00
that can be profitably expended in fiscal year ending June 88		750,000 00

ted in compliance with requirements of section 2 of river and
r acts of 1866 and 1867.

PORT OF LIEUTENANT FREDERIC V. ABBOT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 1, 1886.

have the honor to submit the following report of operations during the fiscal
ng June 30, 1886, for improving the harbor at Charleston, S. C.
n the first course south jetty was suspended on July 7, one mattress, 108
, having been placed, extending the foundation of the jetty 43 feet. The
transferred to the north jetty, and between July 8 and August 15, 2,030
t of second-course mattresses, 55 feet wide, were placed on that jetty extend-
rd from a point 11,090 feet from the shore-end.
as begun on August 21 on the south jetty, third-course mattresses, 44 feet
extending 1,206 feet seaward from a point 7,986 feet from the shore end, being
is work was completed on October 15, 1885.
ew appropriation had been made for continuing the improvements here, and
considered desirable to hasten results as much as possible, the experiment
ing stone along the center lines of the jetties, with as steep slopes as it
ke, was tried. About 5,000 cubic yards of stone were thus placed on the south
ween points 7,986 feet and 14,025 feet from shore, and 4,000 cubic yards on
jetty between points 9,193 feet and 13,687 feet from the shore end.
ne was sufficient in quantity to have formed a ridge about 5 feet high on
ies if the side slopes had been 1 on 1, but it was of course impossible to
with anything like the regularity necessary to raise the jetty to this amount.
in doing this work was that the ridge would be soon leveled off by the
t that even then the stone would raise the jetty more than if it were origi-
ributed over the entire width of the mattresses. Nothing was lost by this
s it was only applied where the jetties were already so near low-water level
ler the further use of mattresses out of the question. When the time comes
he jetties, stone can be deposited as well where the remains of the ridge
t as elsewhere.
d last year, the contractors deserve great credit for the faithful and skill-
which they have done their work. The smallness of the sum available
requently necessary to shift the points at which work was in progress, so
ost could be accomplished with the limited means. This considerably in-
eir expenses for markers, &c.
e 30, 1886, the total length of the foundation course of the north jetty was
t; that of the south jetty was 16,440 feet. The sea end of the former was
, that of the latter 2,500 feet inside of the outer 18-foot curve, these distances
sured on the prolongations of the axes of the two jetties.
dge worked from the beginning of the year till December 31, 1885, at which
llotment for that class of work was exhausted; 76,620 cubic yards of sand

tection may be required here shortly. East of
changed but little.

Morris Island.—The cutting away of the n
has continued, and in a slighter degree the b
the vicinity of the south jetty.

Mount Pleasant.—The two spurs built in
of the shore-line of Mount Pleasant situate
wharf are in good condition. Sand has c
No marked change in the high-water line h
points the bluff is still caving.

Inner Harbor.—No examination was m
ing the past fiscal year. As I stated in
end or entrance has constantly increased
years, and as the increasing volume of
nel cannot fail to have a detrimental inf
in front of the city wharves, while it i
croachment upon the shore-line of Mo
suitable works should be built to pr
entrance. I do not recommend, howe
of any funds which may be appropri
the harbor.

During the cyclone of August 25,
a year before at the mouth of the S
Creek, near the upper end of the
position to obstruct the channel of
partment authorized the removal
provisions of section 4 of the ri
Proposals for doing this were a
jected on account of the excessi
the Department the work was
by the use of the United Stat
commission temporarily for the
forwarded to the Chief of Engi

With the funds next appr
raised to greater heights, an
ward ends may be resumed
purposes.

This work is located in the c
entry. Amount of duties collec

Since the existing plan
appropriations have been

By act of Congress approved
By act of Congress approved
By act of Congress approved
By act of Congress approved
By act of Congress passed A
By act of Congress approv

Total ....

Of this amount th
ations to June 30, 18
Balance yet to be
$1,712,500.
The following dr

Sheet I. Chart show
their construction to

and a
The sh
made in
like a dr
Even while th
than 1 on 50.
can be removed
dredging, but
It is impossible t
18 feet deep, a
the jetties. Smal
experiment on a
bars elsewhere is
and unroofed
any injury was d
the worst of the
As soon after as the
of the jetty channel.
the area covered is
soundings were take
construct the longit
from end to end
to make cross-section
jetty, as nearly at
300 feet beyond the
not only as to the he
bottom adjacent to
enough to get more
itself, as both wind and
section were to be overe
on the south jetty) tha
year than ever before. W
near the center lines of
as possible the general

ARMY.

Dick Shoal the whole b
In places scour has occurr
settlement of the stru
in previous years,
As the soundings in that
the highest part of the jett
general deepening of the bo
appears to have been a good
The best examination t
the ridge work does not av
high.

ARMY.

during the cyclone of Augu
to the northward. On some
during the year the present lo
This comes from the
cross-sections some distance
the north of the jetty, due to the
of Morris Island. No settlement h
from the inner end of the jetty the
on the south side. The maximum
the trench in that case being
of the jetty at this part. No settl
At this point the ebb tide is very sl

om 1 to 3 feet with no trace of scour
crest of a shoal, its settlement is to
has settled more, as it was in breakers
it is probably badly broken up. The
a basis for very exact statements as to

of the jetty projects above water. The
any signs of being piled up more on one
shell-fish have grown on the stones, nor
es. Logs are sticking up in places at con-

CHANNEL.

foot curve, has not changed materially in size.
has been considerably narrowed and pushed
has extended somewhat towards the south
foot curve, has been reduced about one-half.

	Square feet.
	1,550,000
	1,000,000
	525,000

south. The "inner pocket" has retired.
of Jim Evans Shoal and north of Swash Reef has
n Jim Evans and the south jetty. It has deepened
Reef and shoaled in the part next to the north jetty.
12-foot curve has considerably increased during the
advanced somewhat seaward, the greatest change
n portions.

ILL, SOUTH, AND BEACH CHANNELS.

n of either of these channels. The Coast and Geodetic
uding Pumpkin Hill Channel and the bar to the south of
rmed by the chief of the party that a good channel was
pkin Hill and east of South Channel.

SULLIVAN'S ISLAND.

the west of the Bowman jetty has continued. The rest of
but little.

MORRIS ISLAND.

of the head of the island has continued; it is less near the South
s been made to determine its exact amount.

HOG ISLAND CHANNEL.

of this channel has been made.

MOUNT PLEASANT SHORE.

ilt in 1884 to stop the erosion of this shore are in excellent condition.
r ends the sand has collected. There is no marked change in the high-
hough the bluff continues to cave in places.
P. Allen, assistant engineer, has rendered most valuable and efficient
g the past year, and it is with the most sincere regret that I have parted
account of the lack of funds to continue work.
respectfully, your obedient servant,

FREDERIC V. ABBOT,
First Lieutenant, Corps of Engineers,

A. GILLMORE,
ps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels, and commerce at Charleston, S. C., from Ja
1875, to December 31, 1885.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Tota	
				American vessels.			Foreign vessels.				
	Vessels.	Tonnage.	Crew.	Vessels.	Tonnage.	Crew.	Vessels.	Tonnage.	Crew.	Vessels.	Tonnage.
1875	504	382,018	11,949	38	13,144	326	198	88,879	2,404	740	484,04
1876	471	340,439	10,113	44	11,898	335	224	101,272	2,768	739	453,60
1877	400	324,919	9,885	32	13,972	308	236	105,480	2,851	668	444,37
1878	306	322,527	9,623	44	19,935	455	329	163,368	3,967	772	505,83
1879	383	326,681	10,027	39	12,505	319	246	121,503	3,292	668	460,68
1880	441	388,026	10,641	38	12,412	327	191	110,771	2,595	670	511,20
1881	412	399,732	10,377	34	9,430	272	257	121,077	3,073	703	530,23
1882	410	384,690	9,446	35	4,807	224	200	105,647	2,648	645	495,14
1883	345	277,538	7,629	26	3,002	157	239	113,768	2,958	610	394,30
1884	425	304,382	9,822	21	3,910	145	214	134,076	3,269	690	442,36
1885	375	268,477	9,637	15	2,344	97	187	106,233	2,586	577	377,05

CLEARED.

1875	461	328,266	10,830	57	24,670	555	211	94,595	2,527	729	447,54
1876	431	278,744	9,095	60	23,598	540	230	103,276	2,812	721	405,61
1877	335	234,429	7,719	35	22,767	423	250	108,446	2,910	620	365,66
1878	266	172,988	5,801	45	24,397	479	398	149,975	3,591	509	347,36
1879	287	188,212	6,268	34	11,282	292	278	149,052	3,643	599	348,54
1880	296	190,733	6,348	45	23,210	481	246	155,768	3,375	587	369,711
1881	268	187,569	5,942	32	9,239	255	278	153,796	3,464	578	350,60
1882	147	113,699	3,690	40	7,375	273	263	158,250	3,584	450	379,32
1883	98	48,714	2,018	27	4,560	181	299	154,653	3,815	424	207,92
1884	212	116,020	4,555	31	7,845	217	276	161,588	3,727	519	285,45
1885	191	90,658	5,047	24	5,217	164	204	119,602	2,836	419	224,46

COMMERCE.

Year.	Value of exports.	Value of imports.	Dt 1
1875	$19,655,966	$680,343	$
1876	18,088,152	455,562	
1877	16,917,492	161,237	
1878	21,167,575	184,127	
1879	18,693,126	127,981	
1880	24,939,259	248,158	
1881	21,927,269	713,049	
1882	19,907,099	459,970	
1883	20,144,365	467,648	
1884	20,833,424	503,504	
1885	15,157,889	588,191	

THE ASTOR LIBRARY
NY

THE ASTOR LIBRARY
NY

Arrivals and clearances of vessels, and commerce at Charleston, S. C., from January 1, 1885, *to December* 31, 1885.

ARRIVED.

	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
Entered through custom-house	375	268,477	9,637	15	2,344	97	187	106,233	2,586	577	377,054	12,320
Not entered through custom-house	540	284,729	......	....	......	......	....	....	......	540	284,729	......
Total	915	553,206	9,637	15	2,344	97	187	106,233	2,586	1,117	661,783	12,320
CLEARED.												
Through custom-house	191	99,658	5,047	24	5,207	164	204	119,602	2,836	419	224,467	8,047
Not through custom-house	684	427,540	......	....	......	......	....	....	......	684	427,540	......
Total	875	527,198	5,047	24	5,207	164	204	119,602	2,836	1,103	652,007	8,047

THEO. D. JEWEY,
Collector.

M 2.

IMPROVEMENT OF WAPPOO CUT, SOUTH CAROLINA.

The work of improving Wappoo Cut, South Carolina, with funds supplied by the General Government, was begun in November, 1882.

Three appropriations have thus far been made for it by Congress, aggregating $23,000.

Wappoo Cut is a narrow, tortuous, tidal stream, separating James Island from the mainland and connecting Stono and Ashley rivers. An examination of the creek was made under my direction some years ago, the report of which with project of improvement forms part of Appendix J 4, Annual Report of the Chief of Engineers for 1881, and is printed as House Ex. Doc. No. 19, Forty-sixth Congress, third session.

The project of improvement contemplates the establishment of a straighter channel of 6 feet depth and 90 feet width at mean low water, and comprises the following details of work:

1. Dredging on the bar at the entrance into Ashley River;
2. A solid cut through the marsh at the end of the first easterly reach, 2¼ miles from Ashley River;
3. Dredging in Elliott's Cut and the reach leading to it, and on the bar at the outlet into Stono River;
4. Closing by a light bulkhead the three tidal streams that enter this new route from the north;
5. Building a jetty at the Ashley entrance to guide the flood-tide into Wappoo Cut; and
6. Building a jetty at the Stono entrance to guide the ebb tide into the cut.

The aggregate cost of these works was estimated at $34,000.

The mean rise and fall of the tides in Wappoo Cut is about 5 fee

The delays in providing funds for carrying on the work, and the s amounts appropriated, have rendered it impossible to complete work at every point. The unfinished cuts are therefore partially up from caving banks during the unavoidable and prolonged suspe of operations. A considerable increase in the total ultimate cost o improvement is therefore unavoidable.

OPERATIONS PREVIOUS TO JULY 1, 1885.

The work consisted chiefly in dredging. Elliott's Cut was impr through its entire length of about 2,000 feet by establishing a low-w depth of 6 feet, on an average width of 60 feet. A solid cut 800 feet with an average width of 80 feet and a mean low-water depth of 6 was made through the marsh of "Devil's Elbow," securing a str and convenient passage in place of the extremely tortuous route thr the bend bearing that name, which from end to end has a leng about 6,000 feet. A channel of the same depth was dredged thr the shallow bends from Elliott's Cut to the Marsh Cut. Some dred was also done on the bar at the Ashley River entrance to the cut.

In these operations 101,956 cubic yards of sand and mud were remo together with a number of snags, stumps, and overhanging trees.

A bulkhead was built across the mouth of Pompey's Cut, a t branch entering Wappoo Cut at the upper end of Elliott's Cut, w had heretofore carried sand and mud into the navigable channel.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 18

On July 1, 1885, the sum of $3,027.84 was available for continuing work of improvement. Proposals for dredging had been invited J uary 5, 1885, but none were received. In December, 1885, propo were again invited, and two bids were received. With the approv the Department a contract was awarded to Messrs. Ross & Sanfor Jersey City, N. J., the lowest bidders, at the prices stated in the abst of proposals appended hereto.

Previous to beginning operations under this contract a resurve Wappoo Cut was made from Elliott's Cut to Devil's Elbow, to deter where the funds available could be expended to the best advant

The low-water depth of 6 feet contemplated in the project and sec in the adopted line of channel by work previously done was foun have been maintained except near Pompey's Cut, where, at two reac aggregating about 300 feet in length, it had been reduced to from 4 5½ feet by the sloughing of the sides of the channel. The width o feet required by the project had not been established by the previ operations at the termination of which it had varied from 60 to 80 The resurvey proved that these widths had been reduced more or at several points by the caving in of the mud banks of the channel, pecially in the bends between Pompey's Cut and the solid Marsh Cu

It was therefore decided to put the dredge to work to restore the to its former dimensions, and, if possible, to widen it in accordance w the project.

Work under the contract was commenced in April and completed June 19, following. Fifteen thousand and fifty cubic yards of s mud, and broken shells were removed and dumped, at distances of f 1 to 2 miles, in Stono River.

CONDITION OF THE WORK.

improved reaches in Wappoo Cut are in a satisfactory condition. oals which had formed just eastward of Elliott's Cut have been ed, and navigation correspondingly benefited.

ast low-water depth of 5½ to 6 feet exists, except at a small bar Stono mouth of Elliott's Cut, which should be removed when a propriation is made.

commercial value of Wappoo Cut as a sheltered inland route for nsportation of the products of a considerable area of country of Charleston has been referred to in former annual reports. The panying report of my assistant, First Lieut. Frederic V. Abbot, of Engineers, contains a few statistics showing the traffic which through Wappoo Cut during the past year.

n additional funds are provided, the bar at the mouth of Elliott's ll be removed and such other work done in accordance with the g project as a re-examination of the several reaches may show to t important.

e the approval of the project for this improvement the following riations have been made:

f Congress approved March 3, 1881	$10,000
f Congress passed August 2, 1882	10,000
f Congress approved July 5, 1884	3,000
otal	23,000

total expenditures to June 30, 1886, were $22,968.40.

vork is located in the collection district of Charleston, S. C. Charleston is rest port of entry. Amount of duties on imports collected in 1885, $32,741.68.

report of First Lieut. Frederic V. Abbot, Corps of Engineers, is nitted herewith.

Money statement.

1885, amount available	$3,027 84
1886, amount expended during fiscal year, exclusive of liabilities anding July 1, 1885	2,996 24
1886, amount available	31 60
t appropriated by act approved August 5, 1886	5,000 00
t available for fiscal year ending June 30, 1887	5,031 60
nt (estimated) required for completion of existing project	10,000 00
nt that can be profitably expended in fiscal year ending June 30, 1888	10,000 00

nitted in compliance with requirements of section 2 of river and bor acts of 1866 and 1867.

---

t of proposals for dredging in Wappoo Cut, South Carolina, opened December 23, 1885.

Names of bidders.	Price per cubic yard for distance.			To commence.	To complete.
	Not exceeding one mile	More than one and not exceeding two miles.	Not exceeding three miles.		
mas Bogges, jr	26 cents	30 cents	35 cents		
& Sanford	17 cents	19 cents	21 cents	Feb. 1, 1886	Apr. 1, 1886

act awarded to Ross & Sanford at the price stated.

REPORT OF LIEUTENANT FREDERIC V. ABBOT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 1, 188

SIR: I have the honor to submit the following report of work done for the im ment of Wappoo Cut, South Carolina, during the fiscal year ending June 30, 188

In the months of May and June, 1886, about 15,000 cubic yards of dredging done in Wappoo Cut just eastward of Elliott's Cut. The shoals which had fo there have been removed and navigation considerably benefited. A small bar remains near the Stono mouth of Elliott's Cut, and is the most troublesome obst tion at the present time. The funds were not sufficient for its removal after other work was completed.

I am indebted to Mr. E. Willis, of this city, for the following statistics showing traffic which passed through Wappoo Cut during the past year:

Phosphate rock (valued at $225,000)	tons..	50,
Sea-island cotton	bags..	5,
Rice	bushels..	186,
Vegetables	crates..	96,000 to 100,
Fertilizers	tons..	1,
Lumber	feet..	7,000
Aggregate tonnage of tugs, steamers, flats, lighters and sailing vessels using this route	tons..	100,

Very respectfully, your obedient servant,

FREDERIC V. ABBOT,
First Lieutenant of Enginee

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

M 3.

IMPROVEMENT OF ASHLEY RIVER, SOUTH CAROLINA.

The aggregate sum of $4,500 has thus far been provided by Congr in three different appropriations, for improving Ashley River, So Carolina. The first appropriation, $1,000, was made by the act appro June 14, 1880.

Ashley River was examined and partially surveyed, under my di tion, under a provision of the act of March 3, 1872. My report, w project of improvement, is printed as Appendix S 8 of the Annual port of the Chief of Engineers for 1873.

The plan of improvement recommended comprised:

1. The removal of a shoal or bar at a place known as Accabee, tween 7 and 8 miles above Charleston City, where only 9 feet of wa at mean low tide was found in 1873, while the channel of appro to it from below was only about 40 feet in width between the 10-f curves.

2. The removal of a shoal at a point below the the Wando Phosph Works, about 2 miles above Accabee, where only 6 feet of water found at low tide.

It was proposed to lower these shoals by dredging to a low-wa depth of from 10 to 11 feet.

The mean rise and fall of tides in Ashley River is about 5 feet.

The cost of the work was estimated at $5,000. To maintain depths required under the foregoing plan, and obtained by means of appropriations made, occasional dredging will have to be done du the next year, and the original estimate will, therefore, be somew exceeded. In order to render the improvement practically permanent, a revised or enlarged project would be required, providing for wing-dams or other suitable works to direct and concentrate the river currents over the shoal crossings. The principal traffic on Ashley River consists in the carrying to the city of Charleston the products of the mills of the several phosphate companies located above the shoals, but the necessity for incurring the expense of a more permanent and more costly improvement has not yet been urged or become apparent, and therefore no enlarged project has been presented or recommended.

OPERATIONS PREVIOUS TO JUNE 30, 1885.

Dredging was done during the month of February, 1882, at a point of the river known as "The Crossing," at the Wando Works. A channel about 100 feet width and over 1,000 feet in length was cut through the shoal, separating the 11-foot low-water curves on either side, and a depth of 11 feet at low tide was established.

The cost of this work practically exhausted the funds then available.

A third appropriation of $2,000 having been made by the act approved July 5, 1884, proposals were invited for expending the amount in continuing the work. Only one bid was received, and this was rejected, the price asked, 30 cents per cubic yard, being deemed too high.

Nothing else was done except making some local surveys and examinations to select points where dredging would be needed and to ascertain the condition of the channel improved in 1882. It was found to have been satisfactorily maintained.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

In December, 1885, proposals for dredging were again invited, and of the two bids received, the lowest, that of Messrs. Ross & Sanford, was accepted, and the contract was awarded them at 20 cents per cubic yard.

The dredge was put to work at a shoal near the Stono Phosphate Works about 9 miles from the city of Charleston. The depth of the channel here averaged about 9 feet at mean low water. Operations were commenced in April and completed in the following month, 8,566 cubic yards of material having been excavated, forming a channel 11 feet deep and 210 feet wide at mean low water.

The funds next appropriated will be applied to enlarging the channels heretofore dredged, where necessary.

This improvement directly benefits the business of the several phosphate works located above the shoals referred to and thus, indirectly, the commerce of the city of Charleston. I am informed that in the year ending May 31, 1886, 140,597 tons of phosphate rock, valued at $646,000, were transported down the Ashley River.

This work is located in the collection district of Charleston, S. C. Charleston is the nearest port of entry. Amount of duties collected in 1885, $32,741.68.

Since the plan of improvement was adopted the following appropriations have been made:

By act of Congress approved June 14, 1880	$1,000
By act of Congress approved March 3, 1881	1,500
By act of Congress approved July 5, 1884	2,000
Total	4,500

The total expenditures to June 30, 1886, were $4,457.26.

Money statement.

July 1, 1885, amount available	$2,(
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	2,(
July 1, 1886, amount available	
Amount appropriated by act approved August 5, 1886	1,(
Amount available for fiscal year ending June 30, 1887	1,(

Abstract of proposals for dredging in Ashley River, South Carolina, opened Decem
1885.

No.	Names of bidders.	Price per cubic yard.	To commence.	To com
		Cents.		
1	Thomas Boggess, jr	23		
2	Ross & Sanford	20	Feb. 1, 1886	Mar. 1

Contract awarded to Ross & Sanford at the price stated.

M 4.

IMPROVEMENT OF EDISTO RIVER, SOUTH CAROLINA.

By the river and harbor act passed August 2, 1882, the sum of $ was appropriated for improving Edisto River, South Carolina. was the first appropriation made by Congress for this work. B act approved July 5, 1884, a second appropriation was made amour to $5,000.

The Edisto is one of the principal rivers of South Carolina. formed by the junction of the North and South forks, which uni the southern part of Orangeburg County. The South Fork, comm known as the South Edisto, is the main river. It empties into the o near Saint Helena Sound.

Edisto River was examined under my direction with a view t improvement in September and October, 1880. My report, dated cember 31, 1880, with project of improvement, is printed as Appen 15 of the Annual Report of the Chief of Engineers for 1881, and al part of House Ex. Doc. No. 23, Forty-sixth Congress, third session.

It is contemplated to improve the river from Guingard's Landin Aiken County, to the mouth, a total length of 260 miles, so as to e lish a safe navigation at all seasons of the year for light-draught st boats from the sea to the junction of North and South forks, nea crossing of the South Carolina Railroad, 183 miles from the mouth. thence to Guingard's Landing for rafts and flat-boats. It is not dee advisable to attempt an improvement of the reaches higher up w are excessively encumbered with logs and shoals.

The obstructions to navigation consist of numerous bends, logs, sı overhanging trees, and piles, and also of shoals, composed general sand, but in some places of hard clay.

The project of improvement comprises the following details of w

(1) Enlargement and clearing of all the new channels now in process formation.

(2) Forming new channels across necks of bends where needed.

(3) Shutting off lateral arms which now weaken the stream.

(4) Removal of logs, snags, and pile obstructions.

(5) Removal of shoals of sand and clay in one case by building a ecting jetty.

The total cost of the project was estimated at $33,385.

At the present time there exists no reason for augmenting this iginal estimate.

Nothing was done during the past fiscal year, as the balance on hand ly 1, 1885 ($370.14), could not be expended advantageously.

OPERATIONS PREVIOUS TO JUNE 30, 1885.

The work of improving Edisto River has been performed partly by e United States snag-boat Toccoa and partly by hired labor.

Pile obstructions placed in the channel of the river during the late il war at Willtown, 30 miles from the mouth of the river, at Ash eek, a short distance above and near the Charleston and Savannah ilroad Bridge at Jacksonborough, 39 miles from the river's mouth, re removed. A narrow cut-off known as the "Suck" at Norman's nding, 50 miles above Jacksonborough, was widened and deepened d made the regular channel for navigation.

Fragments of the wreck of a steamboat, forming a serious obstruction r Willtown, were also removed. From the mouth of the Edisto to nnedy's Bridge, a distance by river of 130 miles, 11,223 logs, snags, d overhanging trees, varying from 12 to 72 inches in diameter, were oved, in many cases requiring the use of dynamite. Numerous out- into the swamps forming the banks of the river were closed, as well several of those incipient natural cut-offs, known as "sucks" from r tendency to draw log rafts against the banks at their upper ends re these rafts frequently stranded and had to be abandoned. Banks e trimmed at numerous places.

This work was not performed by contract, because from its nature no posals could be made without an excessive margin for contingencies.

The raft navigation of the Edisto on the reaches where operations e carried on has undoubtedly been greatly improved. Lumbermen te that the time of transit of timber and lumber from mill to market now materially less than formerly.

There are at present no steamboats plying on the river, and until the jected improvements are completed such boats, if exceeding 80 feet length and 2 feet draught when loaded, cannot ascend to Friendly's rry, 63 miles above Jacksonborough; and it is not probable that ats of that capacity with the freight suited to them and afforded by locality, viz, shingles, staves, resin, turpentine, &c., could profitably mpete with the South Carolina and the Charleston and Savannah lroads, which traverse the Edisto in this section of the State. Small amers carrying no freight, with sufficient power to tow a number of tboats may in future be employed with advantage.

I am informed that the lumber shipped lately has generally been of comparatively low grade, which is ascribed to the fact that the long-leafed yellow pine has been cut from near the river for many miles p, and can now be found only by going from 6 to 12 miles back. It is thought that when the improvement shall have been completed to ingard's Landing, 77 miles above the junction of the South and North

Edisto, in accordance with the existing project, and still more if the l named branch of the river were more or less cleared and straightened, appears to be urgently desired by the parties engaged in the lumber tr on the banks of that tributary and its affluents, large areas of valu pine and hard-wood land will be brought within reach of the ax The products of the mills can be sent to market more cheaply as stron currents favoring the movement of rafts will be developed, and swamps, being drained by the more rapid flow of water in the river- proper, timber standing back from the banks will become accessi

Parties directly interested in the traffic on the Edisto state that d ing the past year between 45,000,000 and 50,000,000 feet of timber w shipped at a cost 25 per cent. less than four years ago, which saving to a large extent attributable to the improvements thus far made the Government. It is further stated that about 4,400,000,000 feet standing timber are tributary to this river, and that the mill owners a timber men are gratified at being able to reach their markets wi greater ease and safety than formerly.

I respectfully repeat my recommendation of last year, that the nec sary appropriation be made to complete the improvement of the riv in conformity to the approved project.

The additional amount required for the purpose is $20,385.

Since the present project of improvement was adopted the followi appropriations have been made:

By act of Congress passed August 2, 1882	$8,
By act of Congress approved July 5, 1884	5,
Total	13,

The total expenditures to June 30, 1886, were $12,719.33.

This improvement is located in the collection district of Charleston, S. C. Charl ton and Beaufort, S. C., and Savannah, Ga., are the nearest ports of entry.

Duties on imports collected at the custom-house of Charleston, S. C., in 18 $32,741.68.

Money statement.

July 1, 1885, amount available	$370
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	89
July 1, 1886, amount available	280
Amount appropriated by act approved August 5, 1886	3,000
Amount available for fiscal year ending June 30, 1887	3,280
Amount (estimated) required for completion of existing project	17,385
Amount that can be profitably expended in fiscal year ending June 30, 1888	10,000

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

M 5.

IMPROVEMENT OF SALKIEHATCHIE RIVER, SOUTH CAROLINA.

Two appropriations have thus far been made by Congress for impr ing Salkiehatchie River, South Carolina, aggregating $8,000.

The river was examined under my direction during the latter part 1880, and my report of the examination, dated December 29, 1880, printed as Appendix J 16, Annual Report of the Chief of Engine

r 1881, and as part of House Ex. Doc. No. 23, Forty-sixth Congress,
d session.

The Salkiehatchie River, also named the Big Salkiehatchie to dis-
guish it from one of its tributaries, known as the Little Salkie-
chie, rises in Aiken County, South Carolina. These two rivers unite
t 80 miles from the Atlantic seaboard. About 24 miles below the
ction the Salkiehatchie is spanned by the Charleston and Savannah
lroad Bridge. Further down the river is known as the Combahee,
ich discharges into Saint Helena Sound about midway between the
s of Charleston and Savannah.

The mean rise and fall of tides in Saint Helena Sound is 5.9 feet. At
railroad crossing, nearly 60 miles from the river's mouth, it is 2.5
, and the tidal oscillation reaches a point about 20 miles higher up.

PROJECT OF IMPROVEMENT.

The project contemplates the creation of a continuous and practicable
nnel for rafts and flat-boats in the lower reaches of the river from a
t 5 miles above Toby's Bluff down to Hickory Hill, 12 miles below
railroad bridge, and 46 miles above the river mouth, comprising a
l length of river of 77 miles.

The work would comprise the removal of piles at Hickory Hill, and
removal of logs and of the shoals accumulated around them in the
ches above the bridge.

Through Murdock's and Weekly Sand Drags, where the Salkiehatchie
des into numerous insignificent streamlets, cuttings must be made
form a channel of sufficient dimensions for rafts and flat-boats. The
t of this improvement is estimated at $18,000. It is believed that
original estimate will not be exceeded.

OPERATIONS PREVIOUS TO JUNE 30, 1885.

The United States snag-boat Toccoa removed 16 piles to clear the
nnel at Hickory Hill, which had been obstructed during the late
il war; also 106 stumps, snags, and overhanging trees between that
t and the railroad bridge. The operations of the boat were con-
d to this section of the river, the bridge preventing it from proceed-
higher up.

Above the railroad bridge operations were carried on by hired labor,
work being of such a miscellaneous nature as to preclude its being
e by contract without allowing an excessive margin for contingen-

From the bridge to the Forks, a distance of 21 miles, the river was
oughly cleared of obstructions. Higher up, between the Forks
Braxton's Ford, a reach of 59 miles, a large amount of work was
e to improve raft navigation, by removing obstructions, straighten-
the bed of the river, and by shutting off lateral channels.

The number of snags, stumps, logs, and overhanging trees taken from
channel and banks of the river aggregated 11,240; more than a hun-
d outlets were closed; two shoals or islands were removed; twenty-six
d and sand points were cut off, and the banks were trimmed in num-
s places.

No work was done during the fiscal year ending June 30, 1886.

CONDITION OF THE RIVER AND EFFECTS OF THE WORK DONE.

All the reaches where improvements have been made have remained
the same condition, substantially, in which they were left when work

was suspended in May, 1885. Raft navigation has been mat benefited by the work done. I am informed that the cost of transp timber down the Salkiehatchie is now from 33 to 50 per cent. les formerly on account of the improvements made by the Governm

In view of the favorable results heretofore obtained it is recomm that the funds necessary for completing the existing project be sup

An additional appropriation of $10,000 is needed for the purp

Since the adoption of the present plan of improvement the foll appropriations have been made:

By act of Congress passed August 2, 1882	
By act of Congress approved July 5, 1884	
Total	

The total expenditures to June 30, 1886, were $7,924.17.

This work is located in the collection district of Charleston, S. C. Beaufort is the nearest port of entry.

Money statement.

July 1, 1885, amount available	$
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	
July 1, 1886, amount available	
Amount appropriated by act approved August 5, 1886	2,
Amount available for fiscal year ending June 30, 1887	2,
Amount (estimated) required for completion of existing project	8,
Amount that can be profitably expended in fiscal year ending June 30, 1888	8,

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

M 6.

IMPROVEMENT OF SAVANNAH HARBOR AND RIVER, GEORGIA

Operations for improving Savannah Harbor and River, Georgia ing the past fiscal year were conducted in conformity with the enl project based upon an examination made in compliance with s 3 of the river and harbor act, approved March 3, 1881. It was pro in that section that an examination or survey, or both, with estima cost of improvement proper should be made in the Savannah Ri increase the depth of water in said river and harbor, from the bar the city, to 22 feet, and to make an estimate of the cost of wideni channel of the Savannah River opposite the city to 600 feet, of un depth with the balance of the channel.

My report of this examination, dated January 16, 1882, is found Annual Report of the Chief of Engineers, 1882, as part of Appendi and is printed as Senate Ex. Doc. No. 19, Forty-seventh Congres session.

During the two years preceding the autumn of 1873, Congres appropriated the aggregate sum of $100,000 for improving the below the city of Savannah, which was expended mainly in rem wrecks, cribs, and other obstructions.

By act approved February 27, 1874, the sum of $193,132.96 was a priated for the relief of Mr. Henry S. Wells for work done by h removing wrecks, cribs, &c., under contracts with the Treasury D ment of May 1 and July 5, 1886.

PLAN OF IMPROVEMENT.

The project under which operations have lately been carried on is an largement of two previous projects, dated August 28, 1873, and March 1879, respectively. These two projects embraced the following genal details of work:

Widening the water-way at the city front.

Deepening, widening, and straightening the channel by dredging at rious points below the city to the vicinity of Tybee Roads.

A dam at the Cross Tides, 4 miles above the city.

A short bulkhead on the Hutchinson Island side, opposite the upper rt of the city.

Adopting the north channel of the Savannah River for final improvent, in preference to the south channel, from the head of Elba Island, the head of Long Island, which required the construction of a low across the upper end of the south channel, closing the lateral nnels connecting the north channel with the south channel, from ba Island to Cockspur Island, and some shore protection. Such land g the water front on Hutchinson's Island and Fig Island, opposite city of Savannah, as might be needed in widening the channel-way these localities was to be purchased.

he enlarged project embraced in my report of January 16, 1882, comed in substance the features of the two previous plans, and provided dition for a number of works, chiefly wing-dams, that are considd to be necessary for the further improvement of the channel of navtion from Tybee Roads to the city of Savannah, with a view of render the improvement practically permanent. For the details of this ect I beg leave to refer to my annual report for the year ending June 1882.

he total cost of the improvement according to the enlarged project January 16, 1882, was estimated at $730,000, in addition to the sum 482,000 appropriated previous to that date.

OPERATIONS PREVIOUS TO JUNE 30, 1885.

t Cross Tides, 4 miles above the city of Savannah, a dam was concted, formed of brush mattresses and riprap-stone. It is designed duce the volume of water diverted down Back River and to increase ebb flow in Front River past the city front where it is most needed navigation. The work crosses the arm connecting Front and Back r and extends from Argyle Island to Hutchinson's Island, joining rice dikes at either end. The low-water width of the river is here feet; the whole length of the dam, from dike to dike, 1,025 feet.

his structure was commenced in December, 1878. In June, 1882, it reached a height of 3 feet above the level of mean low water, but iderable settlement subsequently occurred at points where the overof water produced damaging scour. To secure the stability of the an apron of log mattresses, loaded with broken stone, was placed g its base and the dam was raised to the level of mean high water e use of brush fascines and riprap-stone.

bout 70 linear feet of the old King's Island crib jetty, near the cross-, was removed to facilitate the flow of water into Front River.

tween King's Island and Hutchinson's Island and lower down the t River (or Savannah River proper) to the city of Savannah, sand mud aggregating about 96,500 cubic yards were removed by dredgo aid the inflow of the tide.

Dredging to an aggregate amount of 279,087 cubic yards was don front of the city to increase the depth of water on Garden Bank S and to widen the river to 660 feet by cutting off the projecting poi Fig Island opposite the wharves of the Savannah, Florida and Wes Railroad.

Three wing-dams, composed of log mattresses and riprap-stone, w constructed opposite the lower part of the city in order to increase strength of the currents by reducing the width and augmenting depth of the water-way at Garden Bank Shoal. Their shore ends on Fig Island. They contract the water-way to about 660 feet; width was formerly from 900 to 1,050 feet.

From 1876 to 1885 an aggregate of 598,393 cubic yards of mate was removed by dredging from the new channel at "The Wrecks." viously about 142,000 cubic yards had been removed from the old Island Channel, the improvement of which was abandoned in 187 recommended in my letter to the Chief of Engineers, dated May 1875.

A training-wall, known as Fig Island jetty, was built for a length about 6,000 feet eastward, or down-stream, from a point a little ab the lower end of Fig Island, with which it is connected by a return w 160 feet in length. The jetty runs about parallel to the right bank the river; its down-stream end rests in 15 feet water at mean low ti The work was built with alternate courses of log and brush mattres and riprap-stone, and is provided on its channel side with eleven sh spurs of similar construction placed at right angles to the axis of T Wrecks Channel. The heads of the spurs are so aligned that the lo water width of the water-way increases from 680 feet at the upper sp to 740 feet at the lowest.

The jetty was originally built up to a height of 2 or 3 feet above t level of mean low water, but the cross-currents producing scour a corresponding settlement at various points, its crest was, for about tw thirds of its length, brought up with brush fascines and broken stone 5 feet above the low-water level.

For better regulating the ebb flow from Front River into the chann at The Wrecks a spur jetty was built about 480 feet above the sho end of Fig Island Jetty.

Two dams, numbered 5 and 11½ respectively, were built to close l teral channels to the northwest and southeast of Barnwell's Island, opp site Fort Oglethorpe. They rise from 2 to 6 feet above the level mean low water, and are designed to increase the flow of water in t main channel abreast of the head of Elba Island.

A submerged dam was constructed across the south channel of S vannah River a short distance below the head of Elba Island. By pa tially closing this branch it was designed to promote the ebb flow in th north channel, which is the one selected for improvement. The qu tion of raising the crest of this dam to a higher level is held in abe ance.

A wing-dam (No. 15) extends eastward from a small mud islan named Barnwell's Island, No. 3, towards the upper end of Elba Islan reducing the width of the water-way, previously nearly 2,000 feet, about half that width.

Three lateral channels, formerly connecting the north channel wi the south channel, have been closed. One of the dams shuts off Ph brick's Cut, at the lower end of Elba Island; another, "Big Gap Dan passes across the channel between Island One-and-Two and Bird Isla and the third closes the two channels between Bird and Long Isla nsiderable work was done toward improving the north channel from Island to the mouth of the river, with a view of deepening the ow reaches at different places where the water-ways were of ex- ve width. These shoals are found at the crossings where the nav- le channel or main line of currents is deflected from one bank to the site one.

e first of these crossings, in going down the stream, is known as Upper Flats. They extend from the lower end of Spirit Island to deep water-way abreast of the middle and lower north shore of Island. While in the deep water-way just above, between Spirit d and the South Carolina shore, the widths of the Savannah River between 1,100 and 1,200 feet, they increase to over 4,000 feet in middle portion of the reach occupied by the Upper Flats.

ree pairs of wing-dams were built here, those of each pair placed site to each other, leaving open a channel of the desired width be- n their heads. The first (upper) pair, Nos. 4 and 23, contract the r-way at the easterly end of the passage between Spirit Island and main shore of South Carolina. The next pair (Nos. 6 and 25) is t 800 yards lower down; and about the same distance further down rd pair (Nos. 10 and 27) was constructed.

ese dams rest with their inner ends upon the shores from which spring, except No. 27, on the north side of the ship-channel, where p of about 500 yards width was left between dam and shore. The h of the water-way left open between the heads of the dams is t feet at the upper pair and 1,200 feet at the lower.

e next shallow crossing improved is named "Lower Flats," or Cab- -Tree Crossing. This reach separates the deep pool at the lower of Elba Island from the deep waters of the anchorage on the op- e shore, in the vicinity of Venus Point, Jones Island. At the upper of this crossing the river has a width of over 2,400 feet; by the truction of a pair of wing-dams (Nos. 14 and 29) the water-way be- n them was reduced to 1,250 feet. At the lower end of the cross- single wing-dam (No. 13) was placed, but not completed; its shore- rests upon the lower end of Island One and Two; it leaves a pas- of 1,250 feet between its head and the opposite shore of Jones Isl-

e third crossing is named Long Island Crossing, a reach of deficient h of water extending from the lower end of the anchorage grounds enus Point across the river to the deep waters abreast of the lower of Long Island. For the improvement of this crossing wing-dams 26 and 33 were built; they reduce the original width of the water- of 3,100 feet to 1,300 feet. These two works, at the close of the ious fiscal year, June 30, 1885, had settled in a few places from 4 to t.

the mouth of the river the existing ship-channel passes between spur Island, on the south, and the shoal known as Oyster Bed, y bared at high water, on the north, the channel being located near atter. There is a wide expanse of water to the north of Oyster Shoal, between it and Turtle Island, for the greater part shallow, uite deep near the shoal where the now abandoned northerly chan- f entrance was located. As very strong ebb currents were observed ntinue to set in that direction, diverting water to the detriment of hannel selected for improvement south of the Oyster Bed, a clos- am (No. 31) was commenced in May, 1885. It is designed to extend m a point on the westerly shore of the. Oyster Bed, between the antine Station and the Oyster Bed (red light) Beacon, northwest to a southerly point of Turtle Island. From that portion of the ri known as "The Obstructions," at the head of Elba Island down Tybee Knoll, northeast of Fort Pulaski, 551,255 cubic yards of mater were removed by dredging prior to June 30, 1885.

In addition to the work described above, a number of wrecks of lar vessels and fragments of wrecks, as well as piles and other obstru tions placed in the river during the late civil war, were taken from t ship-channel.

It is estimated that from December, 1878, when work on the da was commenced—at Cross Tides—to June 30, 1885, the following qu tities of material have entered into the construction of wing-dams, cl ing-dams, and jetties:

Log and brush mattresses, averaging 18 inches in thickness, 280,111 square yar brushwood fascines and brushwood mattresses, 18,230 cubic yards; riprap stone, 60,1 cubic yards.

The aggregate length of all kinds of dams built during the peri mentioned was 29,320 feet, viz:

	Fe
Closing-dam at Cross Tides	1,0
Wing-dams Nos. 1, 2, and 3, at Garden Bank Shoal	9
Wing-dam, Front River below Garden Bank Shoal	2
Fig Island Jetty (6,000 feet) with 11 spurs; total	7,6
Closing-dams Nos. 5 and 11½, Barnwell's Island	1,2
Submerged dam, South Channel	1,4
Wing-dam No. 15, below channel at The Obstructions	8
Three closing-dams (Philbrick's Cut, Big Gap, and Dutch Gap); total	3,2
Wing-dams Nos. 4, 6, 10, 23, 25, and 27, Upper Flats; total	5,0
Wing-dams Nos. 13, 14, and 29, Lower Flats; total	3,00
Wing-dams Nos. 26 and 33, Long Island Crossing; total	2,10
Closing-dam, Oyster Bed Shoal No 31	2,60
Total	29,3

On June 30, 1885, several of the above specified structures still required more or less additional work, some of them not having been completed according to the designs, and others requiring repairs. Wing dam No. 13 had not yet reached the contemplated height, and closin dam No. 31 was unfinished, both as to height and length. Cross Tide Dam, Fig Island jetty, the closing dam at Philbrick's Cut, and some o the wing-dams at the Upper Flats had settled in places, and require to have their crests brought up to the proper level.

The total expenditures to June 30, 1885, for the works above described were $831,614.40.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

On July 1, 1885, a balance amounting to $50,385.60 was available fo continuing the improvement.

Work upon the dams was continued and dredging was resume under the existing contracts, the details of which were given in my las annual report.

The work of construction was confined chiefly to Dam No. 31, at Oyster Bed Shoal. That portion of the dam which occupied comparativel deep water, crossing the westerly end or entrance of the abandone north channel and extending about 1,600 feet northwesterly from th shore end on the shoal, was raised to about the level of mean low water— an increase in height equal to 3 to 4 feet compared with the averag elevation of the top of this part of the dam at the close of the previou fiscal year. The mean depth of the water at low tide along this sectio the work while being laid was 9 feet, with maximum depth of 14 in the immediate vicinity of the Oyster Bed.

oss Tides Dam, the central portion of which was washed out to the d of low water, was repaired during the first months of the fiscal year, its crest raised to the level of high water. Other damages caused a cyclone occurring on October 11, 1885, were likewise repaired, rip-stone, taken from other dams where it could be temporarily spared hout detriment, being used for the purpose.

The closure-dams at Philbrick's Cut and Big Gap, which had settled at e points, were again brought up to the level of mean high water, rmly with the other portions of their respective crests.

The work of raising the crest of Fig Island jetty to a uniform height about 5 feet above mean low tide was finished. Wing-dams Nos. 5, and 27, which, as I stated in my last annual report, had settled several points, had their sunken crests brought up with brush fascines d riprap-stone to an even level. Wing-dams Nos. 26 and 33, Long nd Crossing, which, as already stated, had settled somewhat, were a similar manner raised to an even crest.

Operations under Mr. Gaynor's contract terminated September, 1885. n July 1, 1885, to the close of operations, 12,043 square yards of log-brush mattresses, 4,044 cubic yards of brushwood mattresses and ines, and 4,526 cubic yards of riprap-stone were used in the work.

Between July 1 and October 6, 1885, when work under Mr. Ross' con-t was closed, 38,474 cubic yards of sand and mud were dredged n the several reaches between the city of Savannah and the upper of Long Island, a distance of 8½ miles. The amounts dredged from several portions of the channel were as follows:

	Cubic yards.
Garden Bank Shoal	4,954
the channel at The Wrecks	20,531
the channel at The Obstructions	3,134
the channel at Upper Flats	1,688
the channel at Lower Flats	8,167
Total	38,474

Surveys, &c.—Besides local surveys and examinations made during e progress of the above operations, a line of levels in connection with de-gauge observations, extending from the Cross Tides to Fort Pulaski as commenced and completed.

Parties owning rice-lands upon the upper portion of Hutchinson's sland having preferred claims for damages thereto, alleged to have een caused by the elevation of the low-water level of Front River in onsequence of the construction of the dam at Cross Tides, a series of idal observations was made in the vicinity, and a special report on the ubject was submitted to the Chief of Engineers under date of April 29, 886.

CONDITION AND EFFECTS OF THE WORK.

Cross Tides Dam.—On June 30, 1885, the crest of this dam had been brought up to the level of mean high water. Unequal settlement and a cylone on October 11, 1885, caused slight local breaks, which were repaired. Lately two other breaks have occurred of an aggregate length of about 300 feet, lowering the crest to from 1 to 9 feet. This lowering is not due to settling alone; a great deal of stone is habitually thrown off the work by fishermen and others to secure a shorter route from Back River to the city of Savannah. It is also possible that the press-

ure of water at low tide, at which period since the practical comp
tion of the dam, the water stands very nearly 3 feet higher on the u
stream than on the down-stream side, may have a damaging effect. T
deep-water pockets above and below the dam, referred to in previo
reports, have gained somewhat in depth during the past fiscal year.

In front of Savannah City.—Some shoaling has occurred during t
year opposite West Broad street, but there is still a practicable chan
of 21 feet depth, at mean high water. The channel at Garden Ba
Shoal has also slightly shoaled; the least high-water sounding is n
19.4 feet. Much of the dredging periodically required at these pla
is rendered necessary by the large volumes of sand that are wash
from the city streets into the stream at every rain-storm. The Gard
Bank wing-dams are in good order.

Channel at The Wrecks.—The cyclone of August 25, 1885, did so
damage to the Fig Island jetty, carrying off stone and brush at seve
points, but generally the dam has maintained its crest at the prop
height. Silt continues to be deposited between the short spurs on t
channel-side, as expected and desired.

The least practicable mean high-water depth in the channel at T
Wrecks is now 21.1 feet, a gain of 1 foot during the year. Some sho
ing occurs occasionally at the lower end of the channel. It is expect
that this defect can be permanently remedied by an extension of F
Island jetty and by some dredging.

Channel at The Obstructions.—The shoal at The Obstructions w
lowered more than 1 foot during the year. The least available dep
of the channel is at present 20.9 feet at mean high tide. As suggest
in my last annual report, it is anticipated that the submerged da
near the entrance of and across the South Channel will have to be raise
higher in order to increase the volume of ebb-flow over this shoal an
keep it down by scour. Wing-dam No. 15, near the lower end of th
channel, remains in good condition.

Upper Flats.—The improved mean high-water depth of 22 feet of th
channel at the crossing has been well maintained, except at the low
end, between Wing-dams Nos. 10 and 27, where the depth is six-tent
of a foot less. The wing-dams built for improving this reach are i
good order.

Lower Flats.—The channel here is at present 1 foot deeper than o
June 30, 1885; its least mean high-water depth is now 21.5 feet. Win
dams Nos. 14 and 29 were injured by the cyclone in August, 1885. N
repairs could be made for want of funds. Dam No. 13 is still unfinishe

Long Island Crossing.—The two wing-dams, Nos. 26 and 33, bui
during the previous fiscal year, were damaged by the August cyclon
their crests were considerably lowered, from one to three courses of ma
tresses and riprap-stone having been carried away. It has not bee
possible to make any repairs. Probably, owing to the condition
these works, the channel of the crossing, which had already attained
mean high-water depth of 22 feet, has shoaled to some extent on
length of about 4,000 feet, where there is at present a minimum dept
of from 20 to 20.5 feet. In order to re-establish the required depth of 2
feet it is deemed advisable not only to repair both wing-dams, but also t
build a third one, projecting from a point near the eastern end of Jone
Island, a work which is included in the enlarged project in my repo
of January 16, 1882.

Mouth of river.—Dam No. 31, at Oyster Bed Shoal, is still unfinishe
It was seriously injured by the cyclone of August, 1885, but the dam
ages were partially repaired. Its crest is almost uniformly at the lev

n low water. The channel southwest of Oyster Bed Beacon, ieretofore has always shown a tendency to shoal, has deepened feet during the past year; it has now, everywhere, depths ex- ; 22 feet at mean high water. This result may safely be ascribed effect of Dam No. 31, the completion of which will undoubtedly the present favorable condition of the channel permanent.

ng dams.—The several existing closing-dams below the city of ah are all in good order. A small gap has been left in the dam brick's Cut and one in Big Gap Dam for the passage of small

e it is regretted that for want of an appropriation in 1885 greater s could not be made during the past fiscal year, it having been ticable even to repair many of the damages caused by the storm ust last, it can, nevertheless, be stated that the river is in an ex- condition. During last year several vessels of over 20 feet t have passed from the city to the sea and from the sea to the a single tide. In one instance a vessel drawing 20 feet 9 inches ought in. This had never been accomplished before. From the of draughts appended to the accompanying report of my assist- rst Lieut. O. M. Carter, Corps of Engineers, it is seen that from the present time the available depth in the navigable channel reased 3 to 3.5 feet. As a matter of fact all this increase has place within the last five or six years, while the work of con- ng wing-dams and closing-dams has been in progress.

importance of the city of Savannah as a commercial port seems been amply recognized by Congress through liberal appropria- eretofore made for improving the river and harbor. In view of y favorable results already obtained I earnestly recommend that ds required for completing the improvements in accordance with roved plan may be promptly provided.

oon as an appropriation for this object is made available it is ed to expend it in repairing the damages caused by the late cy- in completing the long dam at Oyster Bed Shoal; raising and hening Cross Tides Dam where necessary; building a new wing- om the lower end of Jones Island, and in dredging at points it may be required.

ork is located in the collection district of Savannah, Ga., at the port of entry. of duties collected in 1885, $45,132.40.

e the works of improvement were commenced the following ap- ations have been made:

of Congress approved June 23, 1874	$50,000
of Congress approved March 3, 1875	70,000
of Congress approved August 14, 1876	62,000
of Congress approved June 18, 1878	70,000
of Congress approved March 2, 1879	100,000
of Congress approved June 14, 1880	65,000
of Congress approved March 3, 1881	65,000
of Congress passed August 2, 1882	200,000
of Congress approved July 5, 1884	200,000
otal	882,000

otal expenditures to June 30, 1886, were $379,056.10.

omplete the work of improving Savannah Harbor and River, a, in accordance with the approved project, dated January 16, here will be required the additional sum of $330,000.

The following drawings and papers are transmitted h

Sheet I. Chart showing works constructed between Fig Island a
June 30, 1886.

Sheet II. Chart showing works constructed between Elba Isla
Island to June 30, 1881.

Report of First Lieut. O. M. Carter, Corps of Engineers, with com
of the port.

Money statement.

July 1, 1885, amount available	
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$47,
July 1, 1886, outstanding liabilities	
July 1, 1886, amount available	
Amount appropriated by act approved August 5, 1886	
Amount available for fiscal year ending June 30, 1887	

Amount (estimated) required for completion of existing project .
Amount that can be profitably expended in fiscal year ending June 3
Submitted in compliance with requirements of section 2 of riv
harbor acts of 1866 and 1867.

◆

REPORT OF LIEUTENANT O. M. CARTER, CORPS OF ENGI

UNITED STATES ENGINE
Savannah, Ga

COLONEL: I have the honor to submit the following report of c
proving the harbor at Savannah, Ga., during the fiscal year ending

The work of constructing wing-dams was continued under the co
the beginning of the year, until September, 1885.

Dredging, which had been temporarily suspended, prior to the
was resumed in August, and was continued until October, when op
pended from lack of funds. During the year an accurate line of le
Cross Tides to Fort Pulaski, for use in the further study and im
river. All existing works were examined during the present month
mine their condition. The adjacent channels were also carefully sc
the same period.

CROSS TIDES DAM.

At the close of the last fiscal year the crest of this dam was at t
high water, the work of bringing it to this height having been don
my report for 1885.

Several slight breaks took place in the dam during the year caus
settlement of the log-mattress foundation. These breaks were rep
time by using brush fascines and stone. Experience has shown
of the size called for by the specifications will not hold here above
but very good results were obtained by building the stone into a so
wall. Even this has not held during the entire year. A great deal
thrown off the dam by fishermen and others interested in securing a
from the Back River to Savannah, and these small breaks have rap
der the pressure of the head of water at the dam.

Gauge-readings taken in January and February of this year s
in the mean low-water levels above and below the dam, of 2.9 feet. I
this difference is greater. There are at present two breaks near t
dam, one of which is 225 feet long and from 3 feet above to 3 feet
water; while the other is 70 feet long and from 1 to 5 feet above
The crest of the rest of the dam has not changed since last year's re
water pockets above and below the dam have deepened somewhat
but their areas have not materially enlarged.

UPPER RICE-MILL.

No work was done here during the year. Two small shoals have fo
nel, just above the foot of West Broad street, the least mean high-wa
which is 20.5 feet. There is still a practicable channel, however,
deep at the same stage. A shoaling of 1 foot has taken place here d

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GARDEN BANK SHOAL.

he wing-dams at this point are in good condition. The shoaling opposite the en-
ice of the discharge-pipe from the gas-works, mentioned in my last year's report,
tinued, and in August, 4,953.89 cubic yards were dredged from the channel in this
ility. The length of the shoal is about the same as at the close of the last fiscal
r, but the channel defined by the 12-foot mean low-water curves has narrowed
ewhat during the year. The least mean high-water sounding in the channel is
19.4 feet, a shoaling of six-tenths of a foot having taken place since the close of
year. There are lumps near the channel, however, on which the high-water
th is only 18 feet, and dredging will soon be imperatively necessary at this locality.
ge volumes of sand are washed from the city streets into the channel here at every
storm, and it will be difficult to keep this shoal removed as long as this is allowed
ontinue.

WRECKS CHANNEL.

uring the months of July and August work on the Fig Island jetty was continued
its crest brought up to about 5 feet above mean low water. In the cyclone of
ust 25 some damage was done to that portion of the jetty between spurs 10 and 11.
rest of the jetty is in good condition, with the exception of a few gaps between
rs 1 and 4, which were caused by the tearing out by unknown parties of stone and
sh to make room for the passage of small boats. The general crest of the jetty
not changed. The silting up between the spurs and along the north side of the
y still continues, but the growth of marsh-grass does not seem to have advanced
since my last report. The least mean high-water sounding in this channel is now
feet, a deepening of 1 foot during the year. Some shoaling has taken place near
y No. 14, at the lower end of the channel, which indicates the necessity for the
her extension of the Fig Island jetty.

OBSTRUCTIONS.

ing-dam No. 15 is in good condition. A cut 45 feet wide was made in September,
onnect the 15-foot mean low-water pools above and below this shoal. The mate-
removed was coarse sand. From causes mentioned in my last year's report some
ht shoaling has taken place since this dredging was done. The last mean high-
er sounding over this shoal is at present 20.9 feet, which is 1.1 foot more than at
close of the last fiscal year.

UPPER FLATS.

ing-dams Nos. 4 and 23 have not changed since last year's report. The gaps ex-
ng in Nos. 6 and 25, at the close of last year, were filled with brush fascines and
ne and both dams brought to an even crest. They are now in good condition. No. 27,
ch had settled slightly in one or two places, was repaired by redistributing the stone
its crest. Both it and No. 10 are in good condition and neither shows any sign of
tlement. The width and depth of the channel at this crossing have been well
intained, and no shoaling has taken place except at the lower end, between dams
s. 10 and 27, where, for a distance of 400 feet, the depth is about 8 inches less than
the close of last year. In September a cut 440 feet long, 45 feet wide, and 15 feet
ep, at mean low water, was dredged through this shoal. The least mean high-water
nding in the channel here at present is 21.4 feet.

LOWER FLATS.

Wing-dams Nos. 14 and 29 were slightly injured in the cyclone of last August. About
feet of the outer end of No. 29 is now 2 feet below mean low water. The outer
lf of No. 14 varies from 3 feet above to 2.5 feet below that level. Neither dam shows
y sign of settlement. Wing-dam No. 13 is still unfinished.

In August a cut 1,960 feet long and 45 feet wide was dredged to 15 feet deep at mean
w water, for the purpose of connecting the deep-water pools above and below this
oal. The upper portion of the cut has deepened since that time from 1 to 3 feet,
d the lower portion—opposite wing-dam No. 13—has shoaled about 6 inches. The
ast mean high-water sounding on the range is now 21.5 feet; a deepening of 1 foot
ring the year.

LONG ISLAND CROSSING.

Wing-dams Nos. 26 and 33, which at the close of the last fiscal year had settled in
few places from 4 to 6 feet, were brought to an even crest in July with brush fas-
nes and stone. These dams were both injured by the August storm. The outer half
dam No. 33 is at present about up to the level of mean low water, while the inner
lf is about 5 feet above that level. The crest of dam No. 26 varies from about 1
ot above to about 4 feet below that level.

The channel defined by the 15-foot *mean low-water* curves is somewhat more irregu-

lar than at the close of last year, and has narrowed to 300 feet between 1
Between stations Nos. 1 and 2 on Long Island a shoaling of about 2 feet has ta
during the year, the 15-foot mean low-water curves being now separated f
other by a shoal about 4,100 feet in length, over which there is a least m
water depth of 13.9 feet. The upper 3-fathom curve below Venus Point has no
during the year, but the lower curve does not extend up-stream as far by
as at the close of last year.

In some places to the northward of the channel a shoaling of from 3.5 to
taken place. The time has now arrived when the proposed contracting wo
lower end of Jones Island should be built.

OYSTER BED SHOAL.

When work was necessarily suspended in September wing-dam No. 31 was u
Its crest throughout is at about mean low water. It does not show any si
tlement. The channel over the old shoal near spar-buoy No. 11, for the imp
of which this dam was built, has deepened in places from 3 to 4 feet during
The width has been maintained, and this shoal can be considered perma
moved.

MISCELLANEOUS.

The Big Gap Dam was repaired in September, by filling up the hole at i
extremity with brush fascines and loading them with riprap-stone. The g
irregular in appearance that fascine mattresses could not be used; but at
water the hole was filled with single fascines, these being placed close toge
their axis perpendicular to the axis of the dam, and loaded heavily with sto

With the exception of a gap about 25 feet in width near its middle this
good condition.

Philbrick's Cut Dam was repaired in the same manner as the Big Gap Da
is at present a gap near the southern end of the dam wide enough for the
small boats. The rest of this dam is all right.

All of the other closing dams on the river are in good order.

At the close of active operations in October the river was in most excell
tion, but work has been at a stand-still since that time on account of lack
and some shoaling has taken place, which could have been controlled fo
smaller sum than will be required for its removal.

During the past year several vessels of over 20 feet draught have passed
city to the sea, and *vice versa*, on a single tide. In one instance a vessel d
feet 9 inches was brought in; a draught of 1 foot 9 inches greater than was
fore brought to the city wharves. The record of draughts, which I append
piled from the pilot records by Captain Kennedy, the harbor-master of the
shows that from 1872 to the present time the available depth of water fro
to the sea has increased over 3.5 feet. At many points this increase has b
greater, and much larger vessels are now able to navigate the river than
years.

Savannah is the chief port of the South Atlantic coast, the second cotto
America, and the first naval-stores port of the world. Her commerce fo
over $67,000,000. I append a table of commercial statistics of the port, fur
the collector of customs.

Charts of the river from Fig Island to Elba Island and from Elba Island
Spur Island are transmitted herewith.

The following table shows the work done during the year:

JETTY WORK.

Date, 1885.	Locality.	Mattresses.	Fascines.
		Sq. yds.	*Cu. yds.*
July, August, September	Dam No. 31	12,042.82	
July, August	Fig Island Jetty		1,540.07
July, August, September	Cross Tides Dam		162.32
July	Philbrick's Cut Dam		154.25
July, August, September	Dam No. 6		329.03
July, September	Dam No. 25		712.99
July	Dam No. 26		166.42
July	Dam No. 33		140.00
September	Big Gap Dam		838.62
Total		12,042.82	4,043.70
By previous reports (1884-'85)		105,095.86	5,634.49
Aggregate during contract		117,138.68	9,678.19

DREDGING.

Date, 1885.	Locality.	Cubic yards.
st	Garden Bank	4,953.89
st, September	Lower Flats	8,167.41
mber	Upper Flats	1,687.73
mber	Obstructions	3,134.05
mber, October	Wrecks	20,531.43
Total		38,474.51
evious reports, (1884–'85)		98,114.20
gate during contract		136,588.71

. A. S. Cooper, assistant engineer, has rendered valuable services during the e year.

Very respectfully, your obedient servant,

O. M. Carter,
First Lieutenant, Corps of Engineers.

l. Q. A. Gillmore,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

als and clearances of vessels and commerce at Savannah, Ga., from January 1, 1873 *to December* 31, 1885.

ARRIVED.

ears.	Coastwise.			Foreign ports.						Total.			Greatest draught.*
				American vessels.			Foreign vessels.						
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	
													Feet.
....	463	381,595	11,934	34	16,140	383	213	119,316	2,999	710	517,051	15,316	17.50
....	418	354,700	10,048	66	41,030	847	281	182,517	4,232	768	578,247	15,127	17.50
....	370	310,877	10,102	67	39,298	781	222	145,748	3,290	659	495,923	14,173	17.50
....	355	320,015	10,348	58	40,832	987	260	169,649	3,865	673	530,496	15,200	17.75
....	333	379,826	10,867	54	40,948	951	287	168,247	3,950	674	589,021	15,768	18.25
....	322	385,532	10,688	61	45,208	1,576	326	235,787	5,814	709	666,527	18,078	18.50
....	319	411,794	8,235	30	21,994	439	279	198,040	3,960	628	631,828	12,634	17.75
....	338	446,881	9,996	14	7,724	170	244	172,224	3,533	596	626,829	13,699	18.33
....	383	508,422	11,069	21	10,729	237	254	151,463	3,474	658	670,614	14,780	19.00
....	391	544,448	12,605	11	4,865	106	204	115,061	2,718	606	664,374	16,429	19.00
....	380	468,226	10,659	10	4,115	90	160	87,025	1,965	550	559,366	12,714	18.25
....	388	482,917	13,735	14	5,632	116	287	174,676	3,984	689	663,225	17,835	19.00
....	395	493,610	14,622	12	5,058	125	251	103,321	3,416	658	661,989	18,163	20.75

CLEARED.

....	466	398,050	13,749	65	30,102	689	224	129,164	3,194	755	557,316	17,632	17.50
....	480	407,295	12,748	71	40,397	822	229	145,038	3,437	780	592,730	17,007	17.50
....	319	284,831	9,376	72	39,311	804	195	128,086	2,924	586	452,228	13,104	17.50
....	410	361,999	11,222	80	49,483	1,163	185	119,699	2,827	675	531,181	15,212	17.75
....	400	439,370	12,081	65	44,829	1,066	161	103,342	2,589	626	587,541	15,736	18.25
....	378	418,958	10,475	64	40,128	1,255	260	183,757	5,375	702	642,843	17,105	18.50
....	365	442,734	8,834	36	24,891	497	223	156,470	3,129	624	624,095	12,460	17.75
....	310	434,864	10,108	26	12,536	271	242	168,255	3,446	578	615,655	13,825	18.33
....	369	508,422	11,458	22	13,052	253	201	180,579	3,745	652	702,053	15,456	19.00
....	350	506,213	11,917	23	9,155	205	209	135,375	3,023	582	650,743	15,145	19.00
....	355	415,720	9,780	10	4,115	90	165	87,400	2,015	530	507,235	11,885	18.25
....	360	452,802	13,363	15	5,634	131	288	194,075	4,315	663	652,511	17,809	19.00
....	414	502,773	14,672	20	8,722	148	228	154,858	3,344	662	666,353	18,164	20.17

*Compiled by the harbor-master.

COMMERCE.

Years.	Value of exports.	Value of imports.	Duties collected.	Years.	Value of exports.	Value of imports.
1873......	$29,850,275 00	$890,664 00	$160,011 77	1880.....	$49,297,981 25	$660,974 00
1874......	50,500,945 94	788,220 00	110,492 74	1881.....	47,448,117 00	952,512 00
1875......	46,004,295 60	511,818 00	61,625 44	1882.....	48,849,033 00	657,255 00
1876......	41,236,581 00	511,528 00	58,163 36	1883.....	50,890,937 00	567,182 00
1877......	33,569,981 00	564,937 00	34,959 93	1884.....	50,934,184 00	696,434 00
1878......	41,793,477 71	505,596 00	23,364 35	1885.....	42,253,397 00	513,286 00
1879......	44,980,070 89	378,782 00	27,778 73			

T. F. JOHNSON
Coll

First Lieut. O. M. CARTER,
Corps of Engineers.

M 7.

IMPROVEMENT OF SAVANNAH RIVER BETWEEN THE CITIES OF AU AND SAVANNAH, GEORGIA.

Operations for improving Savannah River between the cities o gusta and Savannah, Georgia, have been carried on, with repeated missions, from February, 1882, to June 30, 1885, with funds suppli three appropriations made by Congress, aggregating $55,000.

An examination of this portion of Savannah River was made und direction in September and October, 1880, and my report thereon, December 22, 1880, with plan of improvement, appears in Appe 6, Annual Report of the Chief of Engineers for 1881, and is prin House Ex. Doc. No. 23, Forty-sixth Congress, third session.

The distance between the cities of Augusta and Savannah i mated at 108 miles in a straight line, and at 248 miles by river.

For the greater part of the year the river was found to be nav for steamboats drawing from 4 to 5 feet, but during the dry sea autumn the river is very low at various places, and boats had t discharge and receive their cargoes at some point below Augusta

The chief obstructions to navigation were found to comprise sh bars of sand, snags, floating and overhanging trees, and pile obstru

PROJECT OF IMPROVEMENT.

The project for improving the river recommended in my report cember 22, 1880, comprises the following works:

(1) Narrowing the river by low wing-dams where excessive produce or maintain bars.

(2) Aiding the accumulation of silt between the wing-dams b hurdle traverses.

(3) Protecting the banks where needed by thin, flexible, brus tresses weighted with stone, or in some other suitable manner.

(4) Cutting off projecting points of land.

(5) Removing existing pile obstructions.

(6) Removing snags, floating timber, and overhanging trees.

(7) Aiding the formation of the low-water channel in a few loc by dredging.

The object of the plan of improvement is to procure a low-river

not less than 5 feet; and the cost of the works is estimated at
).

perations were carried on during the past fiscal year from want
s.

following is a brief description of the work done thus far:

ly the whole of the first appropriation, amounting to $15,000, was
led in providing a snag-boat, designed to be used in removing
ctions, such as snags, piles, drift-logs, overhanging trees, &c.
r points of the river where the navigable channel was of deficient
luring the low-river stage, caused by undue widening of the water-
nprovement was effected by the construction of wing-dams, com-
substantially as described in my last annual report. Such im-
ents were made at the following places, viz:

ardner's Bar, opposite the lower part of the city of Augusta, five
ams were built, extending a length of about 2,000 feet along the
South Carolina, bank. They reduce the width of the river, orig-
averaging 650 feet, to 350 feet. The right, or Georgia, shore, just
Gardner's Bar, is high and abrupt, and had been caving for many
At eight points of this bank revetting works, similar to the dams,
onstructed. They aggregate 1,375 feet in length, and protect
eet of shore-line.

ourse's Bar, 1 mile below Gardner's Bar, four wing-dams, with
and-ends resting upon the left bank, were built, and one dam from
ht bank. These dams reduce the width of the river in the same
r as the works at Gardner's Bar.

shallow crossing at Sand Bar-Ferry Bar, 4 miles below Augusta,
nproved by building four wing-dams on the South Carolina side
river, and one dam on the Georgia side, with the necessary shore
tions.

t of wing-dams was built at Blue-House Bar, 6 miles below Au-
Two of the dams were arranged as a pair opposite to each other,
l dam was built above, and a fourth below, starting from the
nd left bank of the river, respectively. They reduce the width
river from 700 feet to 400 feet.

operations of the snag-boat Toccoa extended from Cooney Cut
miles below Augusta, to Saxon's Landing, 134 miles lower down.
omprised the removal of 540 snags, 54 piles, 11 large cypress
s, 536 leaning trees, and the wrecks of several flat-boats.

total expenditures for the work thus far done have amounted to
4.85.

n not able to make a statement concerning the present condition
works. During the latter part of the fiscal year, when it was
ed to make an examination for the purpose, the continued high

tions have been made:

By act of Congress approved March 3, 1881
By act of Congress passed August 2, 1882
By act of Congress approved July 5, 1884

Received from other appropriations for use of snag-boat

Total

Of this amount the sum of $57,264.85 had been expended to 1886.

The total cost of the existing project was estimated at $91, I stated in my last annual report, I am not prepared to say amount will carry the work to completion; the improvement, will extend over all the reaches of bad navigation, so as to the work done as far as possible.

Money statement.

July 1, 1885, amount available
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885

July 1, 1886, amount available
Amount appropriated by act approved August 5, 1886

Amount available for fiscal year ending June 30, 1887

Amount (estimated) required for completion of existing project
Amount that can be profitably expended in fiscal year ending June 30, 1888
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

M 8.

IMPROVEMENT OF SAVANNAH RIVER ABOVE AUGUSTA, GE

estimates were submitted, viz:

of improving the river for pole-boat channel, 3 feet by 30 feet, from igusta to Trotter's Shoal, 64 miles	$45,000
of steamboat channel, 3 feet by 90 feet, same route	125,000

ations have been carried on in conformity to the first-named pro-

obstructions to be removed under the adopted project are nu-
, and consist chiefly of rocky ledges running across the channels,
l bowlders of various sizes, and shoals of gravel.
perations have been carried on since August, 1883.
ious to that time, the river was more or less improved at many
within the section embraced in the project, especially in the
each.
n the canal lock, 7 miles above Augusta, to Barksdale, 50 miles
he city, a channel was secured through the obstructions 20 feet
nd 2½ feet deep at summer low water. The work consisted in
ing solid ledge rocks, bowlders, and gravel, and in building wing-
or contracting the water-way, the dams being constructed either
y of broken stone or of brush mattresses and stone combined;
ubic yards of ledge rock, 37 cubic yards of bowlders, and 62 cubic
of gravel were removed.
building the dams nearly 6,670 square yards of brush-mattresses
183 cubic yards of broken stone were used.
o the amount of commerce and navigation to be benefited by com-
this improvement, I beg leave to refer to my report of February
. No additional data have been received since that time.
examination recently made has shown that where the channel was
ned and widened by blasting of rock the river has been much im-
l. Some of the dams put in for the removal of sand-bars have
l effective, but in many cases they appear to have failed, as the
were not sufficiently extensive to produce the desired results.

work is located in the collection district of Savannah, Ga., which is the near-
t of entry. Amount of duties collected in 1885, $45,132.40.

e the work of improvement was commenced, the following appro-
ons have been made:

of Congress approved June 14, 1880	$16,000
of Congress approved March 3, 1881	8,000
of Congress passed August 2, 1882	15,000
Total	39,000

this amount there has been expended from the beginning of opera
to June 30, 1886, the sum of $38,177.29.

Money statement.

1885, amount available	$877 06
1886, amount expended during fiscal year, exclusive of liabilities anding July 1, 1885	54 35
1886, amount available	822 71
t available for fiscal year ending June 30, 1887	822 71
nt (estimated) required for completion of existing project	6,000 00

itted in compliance with requirements of section 2 of river and
bor acts of 1866 and 1867.

M 9.

IMPROVEMENT OF SAINT AUGUSTINE CREEK (THUNDERBOLT RIV GEORGIA.

Of the sum of $5,000 appropriated by act of Congress approved M 3, 1879, $1,582.34 were expended during the fiscal year ending Ju 1881, in the partial removal of the wreck of a large timber dry- which was sunk in the middle of the stream during the late civil

There appears to be no necessity for any further improvement river at this point, and no appropriation is asked.

This work is located in the collection district of Savannah, Ga. Savannah nearest port of entry. Amount of import duties collected in 1885, $45,132.40.

Money statement.

July 1, 1885, amount available	$3,41
July 1, 1886, amount available	3,4

M 10.

IMPROVEMENT OF ROMERLY MARSH, GEORGIA.

The water route through Romerly Marsh forms a part of the inl passage from the Savannah River, Georgia, to the Saint John's Ri Florida. Romerly Marsh is situated to the southeast of Skidda Island, between Wassaw Sound on the north and Ossabaw Sound the south.

My report, dated November 15, 1880, of an examination of Rom Marsh, made under my direction in the latter part of the year 1880, tains descriptions of four different routes that might be selected for provement, with estimate of cost of each. The report is printed as pendix J 19 of the Annual Report of the Chief of Engineers for 18 and in House Ex. Doc. No. 19, Forty-sixth Congress, third session.

Two appropriations aggregating $20,000 have thus far been made Congress for improving Romerly Marsh, Georgia, "by the route de nated in the survey of the engineers as route numbered four." The s of $5,000 was contributed in 1883 for facilitating the work by Georgia and Florida Steamboat Company, under conditions stated my annual report of that year and approved by the Department, a in September, 1885, when the second appropriation made by Gove ment was exhausted, additional funds were again supplied by priv parties to continue and complete the work under similar conditions.

PROJECT OF IMPROVEMENT.

Route numbered four, named in the act of Congress, is the most ea erly one of those that were examined. By this route the northe creek, known as "Dead Man's Hammock Creek," which flows throu the marsh and empties into Wassaw Sound near the mouth of Rome Marsh Creek, is to be connected by a cut with Wassaw Creek, whi flows into Odingsell River not far from the point where the latt empties into Ossabaw Sound. The mean rise and fall of the tide is he about 7 feet.

By this route the existing passage through Romerly Marsh, which exceedingly crooked, with sharp bends and insufficient low-water dept voided, and replaced by one which can be navigated with much onvenience, although it will be over 2 miles longer.

roposed that the new route shall have not less than 7 feet depth low tide, with a minimum bottom width of 48 feet, and side one height to three base, or steeper, if practicable. The length ut through the marsh will be 1,156 yards.

ost of the project was estimated at $38,720, but has been ex- ecause of the intermittent method of carrying on operations, able from periodical lack of funds, which necessitated doing in a considerable portion of the work to restore the cut to its lepth and width which had been diminished by inflowing mud hing down of banks during periods of forced suspension of op-

OPERATIONS PRIOR TO JULY 1, 1885.

ork of opening the cut by route No. 4 has been done exclusively ging, which was commenced in May, 1883. It was started at hern end of the line, at a bend of Dead Man's Hammock Creek, miles by water from the confluence of the creek with Romerly reek, at the head of Wassaw Sound.

ne 30, 1885, the cut had been opened for a length of 1,720 feet, tom widths of from 40 to 50 feet and a depth of 7 feet at mean er. The width at the level of the marsh varied from 105 to 135 ording to the elevation of the ground above low water. One and one thousand one hundred cubic yards of material were , of which about 20 per cent. was taken out in restoring depths ths previously obtained, but lost during the time when opera- re suspended.

tal expenditures to June 30, 1885, including the sum of $5,000 ted by the steamboat company, were $21,156.63.

TIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

ly 1, 1885, a balance of $3,834.37 from the last appropriation ilable for continuing the work. It was expended during the of July and August, 1885, under the contract mentioned in my ual report. Operations under this contract terminated on Sep- 1, 1885. From the beginning of the fiscal year to the date just 11,343 cubic yards of mud and sand had been removed and the nded 300 linear feet toward Wassaw Creek.

position was made about this time by private parties to finish k at their own expense and risk, in accordance with the ap- project and under the supervision of the engineer officer in It being desirable to complete the cut and open it to naviga- oon as possible, I recommended that the proposition be accepted, ndition that the money furnished by the parties in interest should d in the hands of the engineer officer in charge, and the work ted under his official supervision and inspection, and that the States should not be liable for its reimbursement. The recom- ion was approved by the Secretary of War, under date of Sep- 25, 1885, and operations were at once resumed.

ril, 1886, the solid cut through the marsh was completed, and el of 50 feet width at the bottom and 7 feet depth at mean low ened through the shallow water beyond the mouth of the marsh- l sufficiently deep water in Wassaw Creek was reached.

Under this arrangement there were removed, from S
to April, 1886, 99,120 cubic yards of mud and sand, i
cubic yards taken from Wassaw Creek and about 5,000 c
older portions of the solid cut, where some shoaling had
it had been fully opened, due to the absence of through

The total length of continuous cut is 4,117 feet, 3,54
are through the solid marsh and 570 feet at the head of
In the latter creek, a short distance lower down, addit
made, of an aggregate length of 1,600 feet, through three
Nos. 1, 2, and 3 on the accompanying chart.

The establishment of Romerly Marsh Cut, known a
bered four," has required the removal of 211,563 cubic ya

REMARKS ON THE WORK.

A recent examination has shown that, for all practic
improvement contemplated by the project has been ac
navigable channel now exists through the marsh, having
of about 50 feet, and generally a depth of 7 feet at m
Since the opening of the cut it has commenced to deepe
scour, except at its southern end, where the tides from
and Ossabaw Sound meet. In short, while there are s
where dredging would be desirable, there are none wher
for the convenience of navigation.

The new route is undoubtedly an improvement upo
used, which was objectionable on account of its defici
excessive tortuousness. The work is also believed to be
manent, inasmuch as the tidal currents have now an un
and will therefore prevent the settling of deposits of
possible, as suggested in my report of November 15,
dredging may be required occasionally at the points
meet.

The final cost of this improvement has exceeded t
mate of $36,720, for reasons repeatedly given in my form
unavoidable deterioration of the incomplete cut during
operations were suspended from lack of funds. The op
nel from the southern end of the Marsh Cut into Wassa
quired the removal of a larger quantity of material than
Considering the intermittent method of supplying funds
the work, it is thought that it has been done at a re
There can be no doubt that the total expenditure would
siderably increased if Government had not accepted th
private parties to supply funds with which to carry th
pletion. For this reason, and because the benefit of t
could thus be secured to commerce at a much earlier date,
to the Department in my letter of April 13, 1886, that th
for in my last annual report, $14,000, be increased to
supplied in one appropriation, to cover the expenses fo
since September 2, 1885.

I have not been able to obtain statistics showing the an
of commerce interested in this improvement.

The improved route through Romerly Marsh is located in the co
Savannah, Ga. Savannah is the nearest port of entry. Amount
in 1885, $45,132.40.

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Since this improvement commenced, the following appropriations ve been made:

y act of Congress passed August 2, 1882	$10,000
y act of Congress approved July 5, 1884	10,000
Total	20,000

The total expenditures from the beginning of operations to June 30, 886, including the amounts supplied on two occasions by private par- es, were $46,712.57.

A chart showing improvement of Romerly Marsh to June 30, 1886, is rewith transmitted.

Money statement.

ly 1, 1885, amount available		$3,843 37
ly 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$3,346 70	
ly 1, 1886, outstanding liabilities	100 47	
		3,447 17
ly 1, 1886, amount available		396 20
mount appropriated by act approved August 5, 1886		17,475 00
mount available for fiscal year ending June 30, 1887		17,871 20
Amount (estimated) required to pay for completing existing project		4,633 78

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

M 11.

IMPROVEMENT OF ALTAMAHA RIVER, GEORGIA.

The Altamaha is the most important river in Georgia, lying entirely within the boundaries of that State. It is formed by the confluence of the Oconee and Ocmulgee. Its length is 155 miles, with a southeasterly course, and it empties into the Atlantic Ocean through Altamaha Sound, below the town of Darien.

The river was examined under my direction in the latter part of the year 1880. My report, dated November 27, 1880, with project of improvement, is printed in Appendix J 9, Annual Report of the Chief of Engineers for 1881, and in House Ex. Doc. No. 19, Forty-sixth Congress, third session.

The chief obstructions to the navigation of the Altamaha consist in rock ledges running nearly across the river, sand-bars, and snags.

PROJECT OF IMPROVEMENT.

The project contemplates the establishment of a steamboat channel of 80 feet width and 3 feet depth at low-river stage, the cost of which was very roughly estimated at $60,000. This will probably need to be increased, as stated in previous reports. The estimate provides for the removal of about 10,500 cubic yards of rock, of an old wreck and pile obstructions, and of several thousand snags, all in the fresh-water reaches of the river; and also for the dredging of about 8,000 cubic yards of material in the vicinity of Darien. The cost of improving localities where sand-bars occur is included in the estimate, but the latter is but roughly approximate in that respect. I said in my first report that

obstructions from the numerous reaches between the town of
and Ohoopee White Bluff, a distance of 115 miles by river. D
period of about eight months, in which snagging operations c
carried on, 355 snags, 2 piles, and 618 overhanging trees were r

The following work was performed under contracts referred t
former annual reports:

A channel was opened through the rock ledges at Town Blu
Piney Bluff, 1⅝ miles and 19¼ miles, respectively, from the jun
the Oconee and Ocmulgee. At both of these localities a pass
cut through the rock, fully 100 feet wide and 4 feet deep at l
stage, securing a serviceable and permanent channel for rafts ar
draught steamboats from Lumbertown, on the Oconee, to some
below Piney Bluff, over 50 miles by river. This work involve
moval of 1,799 cubic yards of solid rock.

Subsequently work was undertaken for the improvement of
Bluff Bar, situated 63 miles by river below the junction, or the
Altamaha River. The bar consists of coarse shifting sand, an
to the abrupt widening of the river and slackening of current
entrance of Beard's Bluff Lake, a sheet of water about 1 mile in
To secure the removal of the bar by scour a training-wall was l
tending 1,744 feet down-stream from the sand-spit between ri
lake, with two short spur-jetties on the channel side of the up
tion of the training-wall. These dams were formed of courses
fascines, either laid one at a time or made into mattresses,
cines being 15 feet long and from 12 to 15 inches thick at the b
Each course of fascines was covered with an average thickn
inches of broken stone and 4 inches of coarse gravel. Below th
stream end of the training-wall, the opposite bank, being ex
erosion, was protected by a revetment of fascines staked to th
The last-named work was not quite finished at the close of the p
fiscal year.

In constructing the works at Beard's Bluff, 3,051 cubic yard
cines, 650 cubic yards of riprap-stone, and 299 cubic yards o
were employed. The total expenses from the beginning of on

These operations were performed under the contract made on Decem-
r 5, 1884, with Mr. E. H. Gaynor, details of which were communicated
ny last annual report. From July 1 to July 15, 1885, the contractor
nished and put into the work 494.53 cubic yards of brush fascines,
1.27 cubic yards of stone, and 129.59 cubic yards of gravel.

The balance of funds then remaining available being too small to
rrant beginning operations elsewhere, the contract was terminated
ly 15, 1885.

CONDITION OF THE RIVER AND EFFECTS OF THE WORKS.

An examination of the works at Beard's Bluff Bar was made in the
t month of the fiscal year, but the river being at a high stage a
se inspection was impossible. From soundings taken, the training-
ll seemed to be in good order except that in the central portion the
st appeared to have lowered somewhat, from what cause could not
n be ascertained. The shore protection was damaged in some parts.
e works had done good service, however; the channel had more than
required depth of water.

While the upper reach, from the head of the Altamaha to Piney Bluff,
generally in good condition, complaints have recently been made
t some bowlders interfere with navigation at Town Bluff and Piney
ff, the same places where passages were cut through the rock-ledges
e years ago. This matter will be investigated when a new appro-
ation has been made, and when the river is at a sufficiently low
ge.

At Golden Grove Bar, near Piney Bluff, and at "Hell's Shoals,"
ut 17 miles lower down, rocky reefs and bowlders are reported as re-
ring early attention.

The lower reaches of the river, from Darien to Steamboat Cut, 55
es, have been well cleared of obstructions by the snag-boat Toccoa.
her up, to Ohoopee White Bluff, 115 miles from Darien, a good deal
nagging work has been done, but more is yet required. It is also
essary to make a cut at Bug's Suck, and enlarge the cut-off made by
river at Doctor Creek; and it is thought that wing-dams must be
structed for the removal of shoals at Sansavilla Landing, at Ohoo-
White Bluff, Ohoopee Cut, and Marrowbone Bar; Cooper's Bar, 6
es above Darien, especially needs improvement; there is scarcely any
ter over it at low tide.

With any funds that may become available, improvements will be
de at the points named above, in the order of their importance.

In former annual reports I took occasion to point out the importance
Altamaha River as an economical and convenient route for bringing
products of the forests and rice-fields of the State of Georgia to mar-
. The area drained by the Altahama and its tributaries is estimated
14,000 square miles, and Darien is the natural shipping port for its
duce.

To the accompanying report of my assistant, First Lieut. O. M. Carter,
rps of Engineers, is appended an interesting communication, with
mercial statistics, from Mr. W. R. Grubb, deputy collector of the
t of Darien, to which attention is invited. It appears that during
eleven years from January 1, 1875, to January 1, 1886, the ship-
nts of timber and lumber (pitch pine), both foreign and coastwise,
ounted to 762,046,041 feet, valued at $11,043,013,90. The rice ship-
nts during the same period were valued at $924,000. The value of
orts of naval stores during the six years from 1880 to 1885 is esti-

mated at $305,000, and it is reported that the annual shipments
creasing. Mr. Grubb thinks that the port of Darien does not now
the full benefit of the trade in timber which it legitimately should
owing to the shoaling of Doboy Bar. In fact it appears from his
that the greatest draught of vessels has gradually but steadily
ished from 22 feet in 1875 to 18½ feet in 1885. A considerable p
of the timber is for that reason not taken over the bar, but b
from Darien to Sapelo and Saint Simon's, and the value of such c
is recorded at the custom-houses of Brunswick and Savannah.

It is recommended that early provision be made by Congress f
completion of the improvement of Altamaha River, and for beg
that of Darien Harbor and Bar.

This work is located in the collection district of Brunswick, Ga. Darien
nearest port of entry. Amount of duties collected in 1885, $2,359.01.

Since the existing project for improving Altamaha River was ad
the following appropriations have been made for the work:

By act of Congress approved March 3, 1881
By act of Congress passed August 2, 1882
By act of Congress approved July 5, 1884

Total

Of this amount there had been expended to the close of the fisc
ending June 30, 1886, the sum of $34,458.13.

An additional sum of $40,000 is required to be appropriated t
plete the project, which makes the total cost $75,000, or $15,00
than originally estimated. This increase is necessary to provide f
expense of building wing-dams and training-walls, to remove bar
construct bank revetments at some points not covered by the firs
mate.

A sketch, showing improvements at Beard's Bluff Bar in 1886, a
report of First Lieut. O. M. Carter, Corps of Engineers, with co
cial statistics of the port of Darien, are transmitted herewith.

Money statement.

July 1, 1885, amount available		$2
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$2,332 79	
July 1, 1886, outstanding liabilities	40 00	
		2
July 1, 1886, amount available		
Amount appropriated by act approved August 5, 1886		20
Amount available for fiscal year ending June 30, 1887		20
Amount (estimated) required for completion of existing project		30
Amount that can be profitably expended in fiscal year ending June 30, 1888		30

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

REPORT OF LIEUTENANT O. M. CARTER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFIC
Savannah, Ga., June 30,

COLONEL: I have the honor to submit the following report of operations
proving Altamaha River, Georgia, during the fiscal year ending this date.

Operations were continued at Beard's Bluff, under the contract in force at

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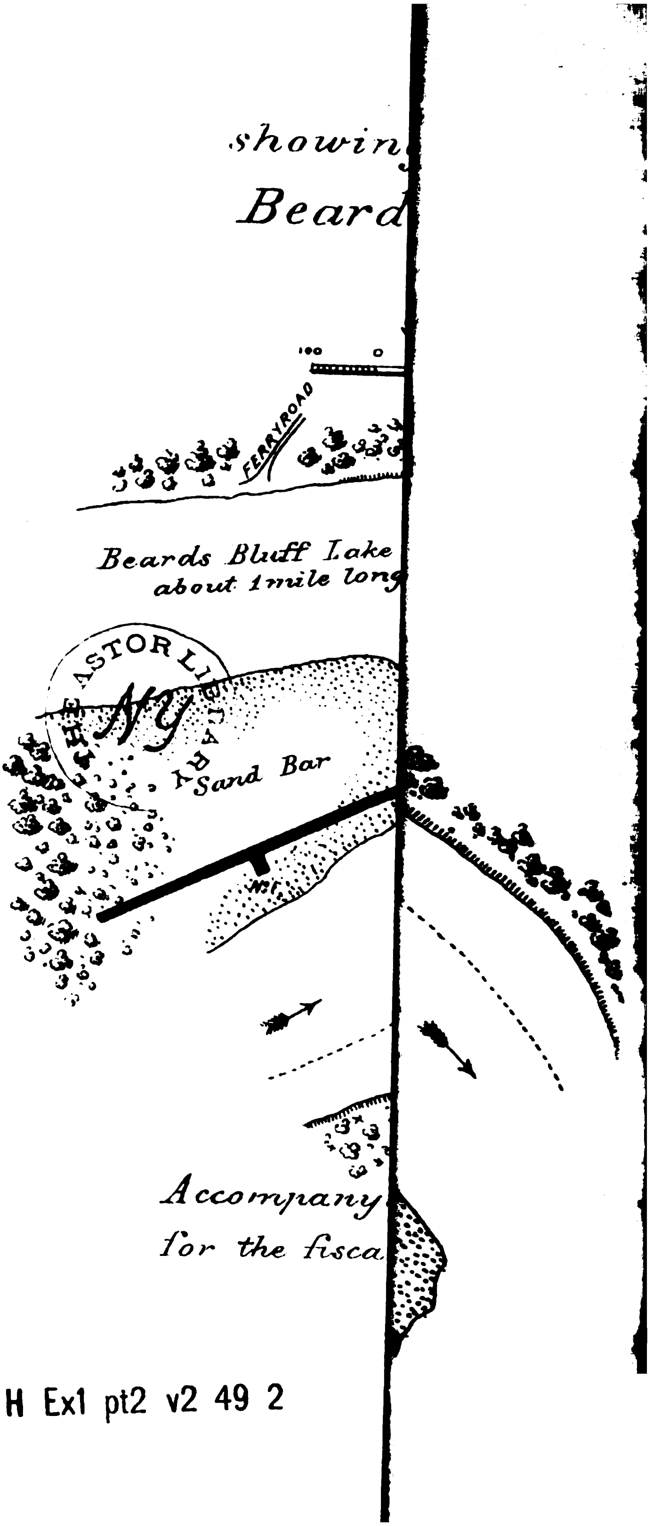

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ning of the year, until July 15, 1885, when the project was completed. The char-er of the work is explained in my last year's report. The sketch herewith shows improvement in its completed state, and the following table exhibits the work ne:

Character of work.	Stone.	Fascines.	Gravel.
	Cubic yds.	*Cubic yds.*	*Cubic yds.*
ining-wall	75.29	117.80	54.59
re protection	85.98	376.73	75.00
Total	161.27	494.53	129.59
previous reports (1884-'85)	649.93	3,050.85	298.85
Aggregate	811.20	3,545.38	428.44

Nothing was done by the snag-boat during the year. An examination of the work Beard's Bluff was made in June. The river was so high that none of the mattresses re visible; but careful soundings were taken over the work and in the channel.

The training-wall appears to be in good condition, and shows no sign of settlement cept near the middle, where it is probable that some of the work has been torn ay by persons connected with the ferry.

A portion of the shore protection has been washed away and some slight caving has ken place here. Some caving has also taken place in the bight above the work d at a point on the right bank of the river about opposite the middle of the train-ing-wall.

The increase of water has been marked since the completion of the work, there be-g now nowhere less than 9 feet of water in the channel, with the Doctortown gauge-ding 8.5 feet.

Golden Grove Bar, at the lower end of Piney Bluff reach, is now the worst shoal on e river, and work at this place and at Hells Shoals is much needed.

Steamboat-men also complain of bowlders in the channel at Town Bluff and Piney ff. The lower portion of the river, from Doctortown to Darien, is in about the e condition as at the close of last year.

Mr. R. L. Hicks, owner and master of the only steamboat plying on the river, esti-tes the value of freight handled by his boat during the year at $302,000, an in-ase of $100,000 over last year.

Mr. R. W. Grubb, deputy collector of the port of Darien, has furnished valuable d interesting information respecting the commerce of the river. His reports ap-nded hereto.

The examination of the river was made by Mr. J. H. Westerfield, assistant en-neer, who has for several years had charge of the snag-boat on this river and on the annah, and who has done much excellent work on both rivers.

Very respectfully your obedient servant,

O. M. CARTER,
First Lieut., Corps of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS OF THE PORT OF DARIEN, GEORGIA.

Articles, &c.	Average annual value.	Total value from January 1, 1875, to January 1, 1886.
ports of timber and lumber (pitch pine):		
Foreign shipments, as per tabulated report, 583,316,741 superficial feet		$7,090,283 00
Coastwise shipments, as per tabulated report, 178,720,300 superficial feet		2,949,730 90
ce:		
Coastwise shipments	$84,000 00	924,000 00
The figures given above are the result of careful investigation, and due consideration has been given to the partial failure of the crops of certain years, and to the fluctuation of prices.		

COMMERCIAL STATISTICS OF THE PORT OF DARIEN, GEORGIA—continued.

Articles, &c.	Average annual value.	Total from 1, 18 uary
Naval stores:		
Coastwise shipments from 1880 up to and including 1885		$2
In the year 1880 the value of naval stores shipments amounted to $12,000. The operations have gradually been extended, until in 1885 the value of shipments, from reliable figures, amounted to $66,000. In 1886 it is estimated they will reach $85,000. Shipments are made in small sailing vessels and in steamers.		
Cypress:		
Prior to 1886 but little attention was given to this wood. Some enterprising Northern gentlemen, the Messrs. Van Gilder & Sons, discovering its abundance along the Altamaha, have now erected a mill at Darien expressly for the manufacture of cypress. This has given a decided stimulus to the industry, and it bids fair to become flourishing ere long. Small parcels of this wood have been shipped for many years. The first complete cargo was shipped during 1886, and before the present year ends two more cargoes will be shipped.		
Hard woods:		
Coastwise and foreign shipments		1
Considering the great quantities of the various kinds of hard woods that may be found along the Altamaha the trade in these woods has not been developed to the extent it deserves. Few entire cargoes have been shipped, but small parcels of oak, ash, hickory, &c., are frequently sent along with pine cargoes. The great obstacle in the way of extensive shipments of oak is the costly and annoying transportation to Darien, it being necessary to attach it to pine or lighter woods to prevent it from sinking. Those of our business men who have any experience in this line are of the opinion that in order to engage in the shipment of oak a liberal investment of capital for flats, tow-boats, &c., would be necessary, but the unsatisfactory state of affairs produced by the insufficiency of water on the bar does not tend to encourage any such investment.		
Hides	$1,000 00	1
About five hundred hides have been exported annually coastwise.		
Brick factory:		
Messrs. Todd & Huntington, out of a clay brought from Sansavilla, about 25 miles from Darien, manufacture an excellent brick. The clay is brought from Sansavilla in flats and the brick manufactured here. So far the manufacture has been regulated by the local demand, but the gentlemen who have the enterprise in hand are now prepared to extend their operations. The quality of the clay has been pronounced superior by experts and the supply is practically inexhaustible. Little or nothing was done in this line prior to 1886.		
Coastwise imports, not entered in custom-house		2, 9
Number of steamers (coastwise) touching at Darien, &c.:		
During the years 1875, 1876, 1877, 1878, 1879, and 1880 the average annual value of coastwise imports amounted to $390,000.		
The years 1881, 1882, 1883, 1884, and 1885 show an average annual value of $325,000.		
During the first six years the number of steamers trading between points up the river—Brunswick, Savannah, and Darien—touching at Darien on an average two hundred and forty times a year, with a gross average tonnage of 63,000 tons per annum.		
Now about one hundred and fifty landings are made, and the average tonnage amounts to about 40,000 tons annually.		
Farm products:		
The annual value of the farming industry is estimated at $7,000. All farm products are disposed of at home	7,000 00	.....
Value of the stevedore business:		
1875, $92,787; 1876, $129,057; 1877, $139,275; 1878, $125,745; 1879, $104,550; 1880, $161,512; 1881, $151,258; 1882, $97,828; 1883, $102,826; 1884, $116,170; 1885, $92,189. Showing the total value for the eleven years to be		1, 3
Value of the towage business:		
1875, $19,875; 1876, $24,766; 1877, $27,452; 1878, $25,165; 1879, $21,400; 1880, $23,763; 1881, $32,957; 1882, $24,548; 1883, $22,987; 1884, $22,151; 1885, $18,439. Showing the total value for the eleven years to be		2
Value of the pilotage business:		
Pilotage on foreign vessels for last eleven years amounted to .. $109,509		
Pilotage on coastwise vessels for last eleven years amounted to. 82,250		1

RAL REMARKS REGARDING THE COMMERCE OF THE PORT OF DARIEN, GEORGIA.

The timber trade.

ar as inclosed official figures of exports tell the tale, our timber trade is on the
ne. Actually it is not. As much timber as ever comes down to Darien from the
r, but the shallowness of water on our bar makes it necessary to ship a large
f our timber to Sapelo and Saint Simon's. While the cost of sending timber from
to Doboy is from 12½ to 15 cents per thousand feet, the cost of sending it to
and Saint Simon's is from 25 to 30 cents per thousand. It is easy to see that this
antage alone will do much to exclude us from competition with other pitch-pine
which have no such disadvantages to contend with. Such shipments also, being
l through the custom-houses of Savannah and Brunswick, go to swell their ex-
and Darien, in consequence, finds it a hard matter to secure anything like the
ition she deserves. The presence of such vessels in our own harbor would ma-
y increase our general trade and add to the importance of the port. While so
these disadvantages have not dealt any serious blow to the interior timber
they certainly have prevented its natural growth and with it the growth of
nmerce generally.

the last five years from 15 to 25 vessels of a large class have annually loaded
arien timber at Sapelo and Saint Simon's, but the quantities and values of these
s are recorded in the custom-houses of Savannah and Brunswick and claimed
ngst their exports. The figures submitted in this report are strictly shipments
ur own harbor.

's and clearances of vessels at Darien, Ga., from January 1, 1875, *to January* 1, 1886.

ARRIVED.

.	Coastwise.			Foreign ports.						Total.			Greatest draught.
				American vessels.			Foreign vessels.						
	No.	*Tons.*	*Crew.*	*No.*	*Tons.*	*Crew.*	*No.*	*Tons.*	*Crew.*	*No.*	*Tons.*	*Crew.*	*Feet.*
....	77	28,063	647	....	....	....	92	47,600	1,198	169	75,663	1,845	22
....	65	23,105	611	....	....	....	124	70,368	1,897	189	93,473	2,508	21
....	104	54,827	1,257	3	674	22	99	50,913	1,231	206	106,414	2,510	20
....	61	29,264	641	2	1,051	20	126	60,109	1,628	189	90,424	2,289	20
....	58	23,275	487	3	1,199	25	115	57,710	1,407	176	82,184	1,919	19½
....	66	21,539	489	1	668	13	134	68,072	1,608	201	90,279	2,110	19½
....	101	40,619	849	3	1,220	29	162	84,456	1,991	266	126,295	2,869	19½
....	117	48,208	909	1	453	9	90	51,421	1,155	208	100,082	2,163	19
....	95	38,173	815	....	....	....	93	49,790	1,135	188	87,963	1,950	19
....	81	34,412	714	2	606	16	92	50,178	1,133	175	85,196	1,863	19
....	78	27,763	682	2	652	16	80	42,587	975	160	71,002	1,673	18½

CLEARED.

....	22	12,214	328	11	4,055	97	104	55,759	1,372	137	72,028	1,797	22
....	39	9,300	270	4	1,553	32	180	87,489	2,263	223	98,342	2,565	21
....	44	13,209	314	4	842	21	169	92,795	2,154	217	106,846	2,489	20
....	28	7,842	181	6	3,009	62	149	83,385	1,947	183	94,236	2,190	20
....	40	14,052	301	7	2,765	57	125	65,433	1,538	172	82,250	1,896	19½
....	55	17,076	393	7	3,589	72	168	84,172	2,016	230	104,837	2,481	19½
....	80	28,492	617	8	3,120	70	184	95,353	2,164	272	126,965	2,851	19½
....	93	34,098	709	6	1,962	46	115	63,525	1,434	214	99,585	2,189	19
....	66	25,019	519	9	3,533	72	108	56,411	1,340	183	84,963	1,931	19
....	59	20,637	457	11	3,977	85	119	66,337	1,478	189	90,951	2,020	19
....	46	16,649	339	8	3,354	62	98	52,742	1,198	152	72,745	1,599	18½

Timber shipments from Port of Darien, Ga., from January 1, 1875, to January 1,

Year.	Foreign.		Coastwise.		Total.	
	Number of superficial feet.	Value.	Number of superficial feet.	Value.	Number of superficial feet.	· V
1875	41,447,024	$557,524	10,992,000	$181,377 00	52,439,624	$73
1876	60,762,000	735,099	8,370,000	138,105 00	69,132,000	87
1877	64,378,000	776,856	11,888,100	196,153 65	76,266,100	97
1878	59,697,124	716,365	7,057,800	116,453 70	66,754,924	83
1879	47,217,818	566,613	12,646,800	208,672 20	59,864,618	77
1880	74,612,520	895,350	15,368,500	253,578 60	89,981,020	1,14
1881	65,420,876	785,050	25,642,800	423,105 20	91,063,676	1,20
1882	36,639,379	439,672	30,688,200	506,355 30	67,327,579	94
1883	42,385,000	508,620	22,517,100	371,532 15	64,902,100	88
1884	50,656,000	607,872	18,573,300	306,459 45	69,229,300	91
1885	40,101,000	501,262	14,984,100	247,937 65	55,085,100	74
	583,316,741	7,090,283	178,729,300	2,949,730 90	762,046,041	10,04

COMMERCE.

Year.	Value of exports.	Value of imports.	T col
1880	$1,621,904	$5,600	$1
1881	1,137,496	3,856	1
1882	1,073,008	1,025	1
1883	969,834	2,334	1
1884	1,038,185	11	
1885	860,500	....	

R. W. GRUBB,
Deputy Collector, Port of Da

First Lieut. O. M. CARTER,
Corps of Engineers, U. S. A.

M 12.

IMPROVEMENT OF BRUNSWICK HARBOR, GEORGIA.

The appropriations made by Congress since 1879 for improving B
wick Harbor, Georgia, in conformity to the original project desc
in my annual report of 1880, printed as Appendix J 7, Annual R
of the Chief of Engineers for the same year, aggregate $70,000.
viously an appropriation of $10,000 had been made by the act app
July 4, 1836, and expended in partially removing a shoal in the
locality at which improvements have recently been made.

The project referred to provided for the construction of a jetty or
ing-wall, projecting from the most easterly point of Buzzard's Islar
cated approximately parallel to and about 1,000 feet distant fro
opposite shore of Brunswick River (East River), for the purpose o
tracting the water-way and concentrating the currents. The p
further provided for more or less dredging along the line of ch
proposed to be improved. The cost of the project was estimat
$73,187.

The object of these operations is to establish and maintain a
channel of 15 feet depth at mean low water, equivalent to about 2
at mean high water, through the shoal located about a mile belo
city of Brunswick, where heretofore there existed a low-water de
only 9 feet. No estimates were included in this plan for works

r end of Buzzard's Island or elsewhere that might eventually be sary for increasing the ebb flow of Brunswick River. The possiy that such works might be needed was suggested in my first anl report on this improvement, where I stated that it was determined mit all work at the upper end of the island as a matter for future ideration.

t has been evident for some years past that the existing project must odified, or rather enlarged, in order permanently to secure the lowg of the refractory shoal to a minimum low-water depth of 15 feet. e enlarged plan embraces the work contemplated in the existing ct, and provides, in addition, for the following work:

) A low dam across Turtle River, extending obliquely up-stream the upper end of Buzzard's Island to the opposite shore of Blythe d. This dam is designed to deflect a larger volume of water at tide into Brunswick River, and thus increase the strength of the nts across the shoal below the city of Brunswick.

2) Dredging in the vicinity of Turtle River Dam to facilitate the ennce of a larger amount of water into Brunswick River.

3) Short spur-jetties in the lower part of the river, either on the right eft bank, or on both banks, to contract the water-way. When the tion of the existing jetty was fixed, it was expected that this work, onjunction with the proposed line of bulkhead on the opposite or shore, would cause the necessary contraction, in order that the curs might produce the desired scouring effects upon the shoal below. bulkhead line, which it was presumed would be built either by the authorities or by the riparian owners directly interested in the imvement of the ship-channel, exists as yet only upon paper. Only heads of a number of piers of open pile-work approximately indie the bulkhead line.

The effects which a bulkhead would have aided in producing may be lized to a satisfactory extent by the construction of spurs. For some tance above the return-face of the existing jetty the width of the er may advantageously be somewhat reduced by building a few wingms from Buzzard's Island, or by extending the jetty up-stream a few ndred yards.

(4) *Jetty.* This work to be raised to a higher and uniform level.

(5) *Dredging on the shoal in Brunswick River.* In the original plan was estimated that 90,000 cubic yards of material would have to be oved at a cost of $17,750. Experience has shown that a larger exnditure will be required for this purpose, the refractory character of a ge portion of the material consisting of compact clay or shell-stone, atly increasing the cost of dredging in the first instance, and the antities to be removed largely exceeding those originally estimated, ing to the fact that in the absence of sufficiently strong currents the edged cuts were repeatedly partly filled in again during the time that ork was suspended from want of funds.

It is estimated that the enlarged plan, herewith briefly described, ill in the aggregate cost from $190,000 to $200,000, inclusive of the ounts heretofore appropriated.

ESCRIPTION OF WORK DONE IN BRUNSWICK HARBOR, GEORGIA, IN ACCORDANCE WITH EXISTING PROJECT OF IMPROVEMENT.

With the usual intermissions, rendered unavoidable by irregular and adequate appropriations, operations have been carried on from Octor, 1880, to May, 1885.

There being no funds available, no work was done during the fiscal year.

The main line of the jetty is now laid to a length of 4,199 feet. head reaches the 18-foot low-water curve of Turtle River. Its u end is located some distance off the projecting point of the east of Buzzard's Island, and is joined thereto by a spur or return-face of feet length. The return-face and the adjoining portion of the j proper are formed of palmetto cribs, attached to platforms of round ber, and filled with brush and dredged material. To insure the st ity of the spur, an apron of log-and-brush mattresses, 30 feet wide, l down by riprap-stone, is placed on the down-stream side along the b of the cribs. Several courses of similar matresses, 20 feet wide, ri to the top of the cribs, and additional courses of mattresses and rip stone placed on top of this submerged work bring its crest up to a he of 2 or 3 feet above mean low water. On the up-stream side of spur its base is likewise protected from scour by mattresses.

Crib-work, topped off with a ridge of riprap-stone, forms 780 lin feet of the length of the jetty proper, beginning at the angle form with the return-face. The low-water depths next to the line of cri spur, and jetty, range from 10 to 18 feet. The remaining portion of jetty, 3,419 linear feet, is built of double-raft mattresses, overlaid w brush and loaded with riprap-stone, averaging 4 feet in thickness o all; they occupy generally more shallow water, varying from 4 to 9 fe except in approaching the head of the work, where the water rapi deepens. The bottom mattresses are 30 feet wide, excepting the l two, which are 40 feet.

The material removed by dredging—sand, loam, and clay, mixed various proportions—aggregated 80,502 cubic yards. The dredging w carried on upon four adjoining lines, parallel to the jetty and about 2 yards east of it. Each cut varies from 20 to 25 feet in width; they co mence a little above the point of the junction of the jetty with its retur face. They were for the most part made to a low-water depth of 1 feet; the longest cut measured 4,840 feet, reaching the 15-foot low-wat curve of Turtle River. Its upper portion, for a length of about 1,0 feet, was only dug to a depth of 12 feet. Two other cuts of 15 fe depth, and each about 4,400 feet in length, approached the outer 15-fo curve, while the fourth cut, of 12 feet depth, extended only about 1,5 feet down-stream from the upper end. The depths of water at low ti on either side of the line and in the vicinity ranged from 8 to 11 feet the time when the dredging was done.

PRESENT CONDITION OF THE WORKS OF IMPROVEMENT, AND BRUNSWICK RIVER IN THEIR VICINITY.

The jetty is in good condition; the riprap-stone covering of the cri and mattresses is well cemented together by oyster-shells and barnacl

No dredging has been done since April, 1883, and in the absence works required for controlling and strengthening the ebb currents, t depths gained at that time have to a great extent been lost, althou the channel at the shoalest places is still from 1 to 2 feet deeper than b fore the improvement was commenced. Some shoaling has taken pla along the city front from Dartmouth street, opposite the upper end the jetty, to a point about 800 yards higher up. The river is here fro 100 to 200 yards wider than either above or below. Aside from t width of the river, which should be somewhat reduced, the shoaling r ferred to may also be ascribed to the fact that vessels up to 200 feet

are frequently moored bow on at the wharves of this reach. For
n of their lengths they thus act as spur-jetties, tending to throw
rents across the river towards the upper end of the jetty, while
g ensues at the inner ends of the vessels, gradually extending
d. At the upper part of the city, where the river is but 200 yards
mple depths exist for any vessels that can cross the sea-bar at
le, which suggests the expediency of narrowing the river just
he upper end of the existing jetty by some wing-dams.
any funds that may become available it is proposed to raise the
jetty to a higher level, and to begin the work of improvement
pper end of Buzzard's Island, in accordance with the enlarged

opulation of the city of Brunswick is rapidly increasing. In
was 2,100; in 1880, 2,900; in 1884, 5.500; and now it is esti-
t 6,000. The city is easily accessible from the sea, with a prac-
mean low-water depth of 16 to 17 feet on the bar, equivalent to
3 feet at mean high water.
the second Trade Issue, Brunswick, December, 1885, a commer-
iodical considered to be well informed on the business of the city,
rs that in 1885 the shipments of timber, foreign and coastwise,
ted 89,750,000 feet, valued at $1,231,282. In the same year the
of naval stores is said to have amounted to 87,453 barrels of
nd 891,863 gallons spirits of turpentine, of a total value of
2. Of another staple article, cotton, 21,788 bales were shipped,
twise, of an estimated value of $1,080,000. In each of the years
, and 1885 the aggregate value of goods exported exceeded
00, and averaged $3,333,653. In previous years the value of
was considerably below that average.
swick is directly connected with the interior of the State of
by two railroads: the Macon and Brunswick Railroad and the
ick-Albany Railroad. Both lines traverse vast tracts of timber
d they are expected before long to connect with other railroads
continuous lines of transportation with the western sections of
drained by the Mississippi. The prospects are that the city of
ick will continue to increase in population and commercial im-
e, and it seems desirable that Government should supply as
possible the funds required to remove the obstructions to navi-
elow the city wharves.

provement is located in the collection district of Brunswick, Ga., at the
try. Amount of import and other duties collected in 1885, $3,939.27.

the present plan of improvement was adopted appropriations
en made as follows:

Congress approved March 3, 1879	$20,000
Congress approved June 14, 1880	10,000
Congress approved March 3, 1881	5,000
Congress passed August 2, 1882	25,000
Congress approved July 5, 1884	10,000
	70,000

is amount there has been expended to June 30, 1886, the sum of
.81.
rt of Brunswick Harbor, showing condition of improvement to
, 1886, and the report of First Lieut. O. M. Carter, Corps of
rs, including commercial statistics by the collector of the port,
with transmitted.

Money statement.

July 1, 1885, amount available		$387
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$125 47	
July 1, 1886, outstanding liabilities	133 77	
		259
July 1, 1886, amount available		128
Amount appropriated by act approved August 5, 1886		22,500
Amount available for fiscal year ending June 30, 1887		22,628
Amount (estimated) required for completion of existing project		97,500
Amount that can be profitably expended in fiscal year ending June 30, 1888		75,000
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.		

REPORT OF LIEUTENANT O. M. CARTER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., June 30, 1886.

GENERAL: I have the honor to submit the following report of operations for improving the harbor at Brunswick, Ga., for the fiscal year ending this date:

On account of lack of funds no work was done here during the year. An examination made during the present month shows the jetty to be in good condition, the rock being well cemented together by oyster shells and barnacles.

During the year a few wharves have been built out beyond the authorized bulkhead line. This, together with the method of mooring vessels at right angles to the wharves, has caused some shoaling along the city front. The 9-foot curve above McCullough's Wharf has pushed out almost to the sailing range, and the channel defined by these curves has narrowed 150 feet during the year. The 12-foot mean low-water channel at the lower end of the city has narrowed somewhat, and does not extend up-stream as far by 375 feet as at the close of last year. Opposite the upper end of the jetty the channel defined by these curves has widened, increased in regularity, and worked down-stream in places about 350 feet. The shoal middle ground has almost disappeared.

The length of the shoal between the upper and lower 2-fathom curves is now 2,600 feet, with a least mean low-water depth on the range of 10.1 feet, a shoaling of half a foot having taken place during the year.

I append a table of commercial statistics of the port, furnished by the collector of customs. The exports have increased from $693,000 in 1875 to $3,063,960 in 1885. The shipments of lumber, coastwise and foreign, during the year of 1885 amounted to 89,750,000 feet. The trade in naval stores has almost trebled in the last 5 years, the foreign shipments during this period having increased at a still greater rate. In 1880 only four vessels were required to carry the naval stores shipped foreign, while in 1885 twenty-eight vessels were required to carry the 84,983 barrels of rosin and spirits of turpentine exported.

A chart showing the present condition of the improvement is transmitted herewith.

Very respectfully, your obedient servant,

O. M. CARTER,
First Lieutenant, Corps of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

July 31, 1886.
1886.
illmore
Engineers
nl. U.S.A.

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COMMERCIAL STATISTICS.

ls and clearances of vessels, and commerce, at Brunswick, Ga., from January 1, 1878 *to December* 31, 1885.

ARRIVED.

rs.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	Vessels.	Tonnage.	Crew.	Vessels.	Tonnage.	Crew.	Vessels.	Tonnage.	Crew.	Vessels.	Tonnage.	Crew.
....	116	32, 584	850	36	10, 218	270	41	19, 008	493	193	61, 810	1, 613
....	148	44, 397	1, 090	33	8, 235	232	40	17, 589	468	221	70, 221	1, 790
....	271	77, 656	1, 892	36	11, 219	317	39	14, 996	432	346	103, 871	2, 641
....	279	100. 451	2, 239	13	4, 174	98	63	30, 279	751	355	134, 904	3, 088
....	335	123, 149	2, 659	7	2, 005	57	63	26, 958	694	405	152, 202	3, 416
....	299	110, 302	2, 368	11	4, 814	107	87	40, 765	979	397	155, 881	3, 454
....	239	88, 063	1, 893	10	4, 434	88	126	62, 818	1, 435	375	155, 315	3, 416
....	242	93, 280	1, 928	10	3, 216	97	94	43, 284	1, 037	346	139, 780	3, 052

CLEARED.

....	124	32, 767	874	28	9, 231	236	49	21, 218	550	201	63, 216	1, 660
....	157	42, 345	1, 116	21	7, 172	172	47	21, 730	555	225	71, 247	1, 843
....	270	78, 913	2, 010	14	5, 010	115	48	19, 970	550	332	103, 900	2, 675
....	252	82, 155	1, 732	17	7, 218	156	87	42, 659	1, 014	356	132, 032	2, 902
....	278	96, 170	2, 086	19	7, 761	170	101	48, 699	1, 139	398	152, 630	3, 395
....	257	91, 036	1, 962	28	11, 268	240	124	55, 717	1, 369	411	158, 021	3, 571
....	176	62, 927	1, 322	38	16, 209	335	148	70, 612	1, 633	362	149, 748	3, 290
....	196	71, 345	1, 481	21	8, 696	190	135	62, 437	1, 456	352	142, 478	3, 127

COMMERCE.

Years.	Value of exports.	Value of imports.	Total collections.
....	$1, 372, 842	$400	$4, 500 97
....	1, 394, 401	3, 197	5, 644 33
....	1, 702, 570	8, 098	17, 723 27
....	2, 230, 000	4, 377	29, 305 30
....	2, 700, 000	2, 739	20, 058 90
....	3, 437, 000	3, 033	24, 911 61
....	3, 500, 000	958	19, 730 32
....	3, 063, 960	4, 008	3, 939 27

Comparative statement of receipts and shipments of naval stores.

Receipts (barrels).						Shipments (barrels).							
Stock on hand.		Receipts for year.		Total.		Coastwise and interior towns.		Foreign.		Stock on hand.		Total.	
Rosin.	Spirits.	Rosin.	Spirits.	Rosin.	Spirits.	Rosin.	Spirits.	Rosin.	Spirits.	Rosin.	Spirits.	Rosin.	Spirits.
3, 000	600	36, 495	8, 661	39, 495	9, 261	29, 339	8, 371	7, 201	650	2, 935	240	39, 475	9, 261
2, 935	240	67, 562	13, 490	70, 297	13, 730	37, 029	8, 621	18, 077	3, 009	15, 191	2, 100	70, 297	13, 730
15, 191	2, 100	104, 357	23, 459	119, 548	25, 559	46, 785	11, 533	52, 972	11, 826	19, 791	2, 200	119, 548	25, 559
19, 791	2, 200	80, 078	16, 105	99, 769	18, 305	9, 846	5, 183	74, 687	12, 229	15, 236	893	99, 769	18, 305
15, 236	893	105, 622	23, 449	120, 858	24, 342	22, 859	2, 565	98, 983	20, 167	8, 016	1, 610	120, 858	24, 342
8, 016	1, 610	92, 958	20, 900	100, 974	22, 510	20, 107	3, 556	68, 814	16, 169	11, 963	2, 785	100, 974	22, 510

JACOB E. DART,
Collector.

st Lieut. O. M. CARTER,
Corps of Engineers, U. S. A,

M 13.

IMPROVEMENT OF THE ENTRANCE TO CUMBERLAND SOUND, BETW GEORGIA AND FLORIDA.

The plan for the improvement of the entrance to Cumberland So Georgia and Florida, submitted with my report of June 30, 1879, prin as Appendix I 8, Annual Report of the Chief of Engineers for 1879, c prises the construction of two low jetties composed of riprap-stone res upon a foundation mattress of logs, or logs and brush, starting, resp tively, from the shores on opposite sides of the entrance and exte seawards across the bar upon lines so directed that the outer ends be parallel to each other and from 3,000 feet to 3,500 feet apart, or distance as may hereafter be deemed necessary. The available water depth has heretofore varied from 11 feet to 13 feet, with a rise and fall of tides of about 6 feet. Two low jetties reaching ent across the bar would be expected to maintain a low-water channel less than 20 to 21 feet deep. Greater depth may be secured by ca ing the jetties to higher levels.

The cost of the work was estimated at $2,071,023.

On account of the small appropriations hitherto made for this provement, entirely disproportionate to its magnitude, and the frequ and prolonged suspension of operations resulting therefrom, this o nal estimate of cost will probably be considerably exceeded.

Four appropriations have thus far been made for improving the trance to Cumberland Sound, aggregating $255,000.

No work was done on the jetties during the fiscal year just clo no funds being available for the purpose.

SUMMARY OF WORK DONE TO THE PRESENT TIME.

North jetty.—This work was commenced in June, 1881. From i shore end on Cumberland Island, the foundation course or apron, co sisting of log and brush mattresses overlaid with broken stone, exte 2,200 feet on a range bearing south 63½ degrees east, crossing Cumberl Channel. It then follows a range bearing south 80 degrees east fo length of 5,172 feet. The total length of the apron is therefore at pres 7,372 feet. Its seaward end is located in shallow water not far fr the North Breakers, north of Pelican Shoal. The mattresses are fro 25 to 52 feet wide, and from 19 to 22 inches thick. At the deeper p tions of Cumberland Channel, for a length of 1,493 feet, a second cour of mattresses, 20 feet to 25 feet wide, rests upon the bottom cour Here the foundations for two spurs were also laid on the south side the jetty. Thus far 15,612 cubic yards of riprap stone have been us in the work.

South jetty.—The south jetty was commenced in June, 1882. I starting point is located on the eastern shore of Amelia Island, abo 5,700 feet from Fort Clinch. The bottom course has been laid to aggregate length of 7,667 feet, the mattresses varying from 40 to 1 feet in width. The jetty, from its starting point on Amelia Island, fo lows a course due east for a distance of 1,619 feet. Thence it is la for the balance of the length of bottom course so far constructed, up a range north 68 degrees 32 minutes east. The mattresses are about inches thick, and are loaded with an average of 12 inches of stone. F about half a mile the jetty is laid in comparatively shallow water; t rest of the work, extending seaward, passes through water of from 17 20 feet depth at mean low tide.

he south jetty has at present reached a point upon the inner slope e bar whence another more easterly range will be adopted, when ations can be resumed.

he following quantities of material have been employed in the work the beginning of operations to the present time:

	Mattresses.	Riprap-stone.
	Square yards.	*Cubic yards.*
jetty	46,480	15,612
jetty	74,170	23,280
Total	120,650	38,892

he lengths of the foundation courses of the two jetties, measured g their axes, are as follows:

ength of foundation course of north jetty, June 30, 1886, 7,372 feet. gth of foundation course of south jetty, June 30, 1886, 7,667 feet.

EFFECTS AND CONDITION OF THE WORKS OF IMPROVEMENT.

survey of the entrance to Cumberland Sound was made in July and ust, 1885, a chart of which, with my report, dated November 28, 5, has been submitted to the Department. An additional examina- was made in June, 1886.

hese investigations disclosed some interesting facts when comparing r results with those furnished by a survey made in April, 1883.

ver large portions of the bar, where the new ship channel is to be ated, the depth of water has increased. The 18-foot low-water curve the inner slope of the bar, actually a pocket formed by the eastward tinuation of the marginal 18-foot curves of Amelia Basin, was, in ust, 1885, found to have worked out about 3,000 feet since 1883, in June, 1886, had again receded 1,350 feet, so that at that time the al advance since 1883 amounted to about 1,650 feet, extending to a t about one-fourth of a mile in advance of the present outer end he south jetty.

ompared with its location in 1883, the outer 18-foot curve, beyond crest of the bar, had in August, 1885, receded from 350 to 400 feet, in June, 1886, it had again moved seaward from 75 to 220 feet. onsequence of these changes the nearest distance between the r and outer 18-foot curves of the bar was 4,000 feet at the end of last fiscal year, while in April, 1883, it exceeded one mile.

lthough at the present time the hydraulic condition of that portion he bar where the new permanent ship-channel will be located is as favorable as during the first months of the past fiscal year, it is ent that depths have generally increased, and the inner 18-foot e has advanced about 550 yards nearer to the bar-crest since 1883, ing a pocket in conformity to the line of channel designed to be ted. This result may well be ascribed in a large measure to the t seaward extension of the foundation of the south jetty, which amounted to over 3,500 feet since December, 1884.

Pelican and other shoals to the north of Amelia Basin have d their position to the eastward; their aggregate area exposed at ater in August, 1885, was considerably less than in 1883.

local deepening of Cumberland Channel, where it is crossed by orth jetty, has continued. In 1881, before the work of improve-

ment had been commenced, the maximum low-water depth was
12½ feet. In 1883, when the bottom course of the jetty had alread
tained its present length, depths of from 16 to 17 feet had develop
either side of and near to the work. The survey of 1885 show
ther increase of depth, chiefly to the southward, where up
of water was found in the month of August of that year.
actually merely a deep pool which rapidly becomes more
going further south; it probably owes its origin to the water com
over the submerged jetty at flood-tide. A settlement of about 5
has taken place here; this matter must be attended to as soon as
shall become available.

The shore-ends of both jetties are well sanded over, and the s
lines in their vicinity are steadily growing seawards, especially a
south jetty, where since September, 1885, the low-water line ha
vanced about 1,000 feet, and "Kingsley's Bank" is now practi
joined to the shore.

The portions of the north jetty bare at low-water are in good c
tion, the stone covering being well compacted by the growth o
nacles. Where logs of mattresses are exposed, the work of the t
can be observed, but no material damage seems to have been
The mattresses of the south jetty, laid in 1884 and 1885, have sa
over well.

The 12-foot and 18-foot curves forming the margins of the
anchoring ground known as Amelia Basin have not materially ch
their positions of late years, except that at a point about 2,00
southeast of the present seaward end of the north jetty the nor
marginal 12-foot curve now bulges out northward, forming a p
from 1,200 to 1,500 feet long. The pocket is located upon the sit
shoal which was formerly bare at low water or had depths of f
foot to 4 feet. Further north, on the range of the pocket, the de
water in this vicinity is found, and it is possible that a new ch
may be formed here that will ultimately take the place of Cumbe
Channel when the latter shall have been obstructed by raising the
of the north jetty, unless it is prevented by an early extension o
jetty.

Noticeable changes in the sailing line across the bar are to be reco
In 1880, vessels approaching from the sea followed a course be
west-southwest, practically parallel to the second range upon whic
south jetty was since laid, and about 1,200 feet to the northward
In 1881, however, the line in approaching the bar had a direction a
due west until it intersected, somewhere in the vicinity of the cr
the bar, the line of 1880, which the vessel then followed. The
channel, therefore, formed an obtuse angle opening southward. I
the channel had again straightened out, but had traveled about 20
southward, with nearly the same bearing as in 1880. It remai
that position for over two years, but in September, 1885, another s
ward movement was observed, parallel to the former direction an
proaching the south jetty to within from 800 to 880 feet, still ru
a straight course.

In April, 1886, another change occurred, similar in character to
which took place in 1881. The sailing line on the inner slope of th
had moved still further south, and was then about 600 feet north o
present seaward end of the jetty, but on the crest of the bar it fo
an angle, passing almost due east across the outer bar-slope into
water. If the jetty were extended on its present range about
yards, it would intersect the outer leg of the angle of the sailing l

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ong ebb current sets to the southeast across the south jetty,
as settled somewhat at the angle formed by its two range lines.
evident that the extension of both jetties should be proceeded
gorously to promote the connection of the 18-foot curves on the
id outer slopes of the bar, and to prevent the channel of navi-
rom shifting from place to place. By comparison with the chart
the length of the bar channel between the 18-foot curves has
hed 4,500 feet, and its least practicable depth has increased 1
ie shoalest low-water sounding in the present range is now 14
iereas heretofore 13 feet was the greatest available depth.

any funds that may become available, it is proposed to extend
ndation-course of the jetties and raise them to a higher level,
protect by suitable works the north jetty from undermining by
here it crosses the deep portion of Cumberland Channel.

dvantages possessed by the port of Fernandina, on account of
capacity and well-sheltered anchorage, have been referred to
ious Annual Reports. Attention is invited to the commercial
s appended to the accompanying report of my assistant, First
). M. Carter, Corps of Engineers. It appears from them that
l commerce of the harbor of Fernandina during the eleven years
December 31, 1885, was valued at $31,940,235.

ork is located in two collection districts, the north jetty being in the collec-
rict of Saint Mary's, Ga., and the south jetty in that of Fernandina, Fla.
na is the nearest port of entry. Import duties collected during the year
51.

ollowing appropriations have been made for the improvement
ntrance to Cumberland Sound:

Congress approved June 14, 1880	$30,000
Congress approved March 3, 1881	100,000
Congress passed August 2, 1882	50,000
Congress approved July 5, 1884	75,000
tal	255,000

xpenditures to June 30, 1886, aggregated $254,235.36.

the cost of the approved project is estimated at $2,071,023, an
te sum of $1,816,023 remained to be provided for by appropri-
n July 1, 1886.

rt of the entrance to Cumberland Sound showing condition of
rovement to June 30, 1886, and the report of First Lieut. O. M.
Corps of Engineers, with commercial statistics furnished by the
r of the port of Fernandina, are herewith transmitted:

Money statement.

85, amount available		$3,698 31
86, amount expended during fiscal year, exclusive lities outstanding July 1, 1885	$2,566 69	
86, outstanding liabilities	366 98	
		2,933 67
86, amount available		764 64
ppropriated by act approved August 5, 1886		112,500 00
vailable for fiscal year ending June 30, 1887		113,264 64
t (estimated) required for completion of existing project		1,693,523 00
t that can be profitably expended in fiscal year ending June 88		600,000 00

ted in compliance with requirements of section 2 of river and
r acts of 1866 and 1867.

REPORT OF LIEUTENANT O. M. CARTER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., June 30, 1

COLONEL: I have the honor to submit the following report of operations f proving the entrance to Cumberland Sound, Georgia and Florida, during the year ending this date. On account of lack of funds no work was done on eithe during the year.

During the months of July and August, 1885, a survey of the bar was made. disclosed some important changes since the survey of 1883. In the vicinity north jetty the high-water line had advanced seaward from 200 to 290 feet, an low-water line from 350 to 450 feet. Near the south jetty the high-water lin extended seaward from 200 to 220 feet, and the low-water line from 200 to 300 f

The shoals along the northern side of the channel had diminished in area, an shifted to the eastward from 1,000 to 2,500 feet, one shoal, bare at low water, h formed near Station E (the north dome of the wreck of the City of Austin), wh 1883 there was a depth of from 10 to 15 feet of water.

Near the sea end of the north jetty the 2-fathom curve had pushed northward, ing a pocket about 1,500 feet long, where in 1883 there was only from 1 to 4½ f water. This same curve had moved southward near Station E about 500 fee had pushed in a northeasterly direction out over the bar. The inner 3-fathom had crossed the south jetty about 2,100 feet beyond the angle, and pushed t southeastward about 2,350 feet. In the bar channel this curve had advanced sea over 3,000 feet, while the outer 3-fathom curve had moved shoreward, encroachi the bar from 350 to 400 feet. The outer bar-channel had moved to the southwa feet.

An examination made during the present month shows that the shore ends of jetties are well sanded over. Those portions of the north jetty visible at low are in good condition, the rock covering being cemented into a solid mass by a barnacles, &c. Where the logs are exposed they have been attacked by the te but no sensible damage has been done to the work. The shore line is making o the ends of both jetties. The low-water line near the south jetty has extended ward since September about 1,000 feet, and "Kingsley's Bank" is now practi joined to the shore.

The Pelican and other shoals to the north of the channel have increased in and have shifted their position since September, but time was lacking to instrum ally determine these changes. A strong ebb current now sets to the southeast a the south jetty, and some subsidence has occurred near the angle. The mattr laid in 1884-'85 have, however, sanded over well, and an average shoaling of a 1 foot has taken place on this section of the jetty.

At a point about 1,700 feet from the shore end of the north jetty a settleme about 5 feet has taken place. The rest of the jetty is in good condition.

On the northern side of the bar channel the 15-foot curve has moved to the so ward since September about 1,200 feet. On the southern side of this channel it moved in the same direction about 150 feet.

The inner 3-fathom curve does not extend out so far by 1,350 feet as in Septem while beyond the bar this curve has moved seaward from 75 to 220 feet. The ea end of the bar channel has shifted to the southward since September a distance of 1,800 feet, measured along the outer crest of the bar, the rate of change in this dire being ten times greater than any hitherto known. The length of the bar chann tween the 3-fathom curves has diminished by 4,500 feet since 1843 and its least d has increased 1 foot. The shoalest low-water sounding on the new range is at pr 14 feet, and vessels drawing 19 feet are being carried over the bar.

Commercial statistics of the port, furnished by the collector of customs, are pended hereto. Additional information concerning the commerce of the port, w will be forwarded directly to you, is being prepared by the receiver of the Fl Railway and Navigation Company.

A chart showing the condition of the jetties and the present depths on the b forwarded herewith.

Very respectfully, your obedient servant,

O. M. CARTER,
First Lieut. of Engine

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

rivals and clearances of vessels, and commerce at Fernandina, Fla., from January 1, 1875, *to December* 31, 1885.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
5	212	117,363	4,192	47	10,379	359	12	7,437	135	271	135,179	4,686
6	210	141,354	4,749	25	4,893	179	28	9,232	249	263	155,479	5,177
7	150	100,581	3,343	31	8,768	217	40	12,547	404	221	121,896	3,964
8	183	120,845	3,900	17	3,985	101	22	8,294	215	222	133,124	4,216
9	205	133,020	4,138	28	10,634	252	10	5,639	126	243	149,293	4,516
0	270	146,722	4,470	34	22,396	598	22	9,463	240	326	188,581	5,308
1	273	171,548	4,186	17	11,899	314	24	11,593	271	278	195,040	4,771
2	239	146,383	3,279	16	9,056	242	15	6,639	151	270	162,078	3,672
3	183	96,937	2,453	6	1,769	43	14	5,229	137	203	103,935	2,633
4	176	105,061	2,864	3	865	21	10	4,029	88	189	109,955	2,973
5	169	111,698	3,131	7	999	47	22	9,785	210	198	122,482	3,388

CLEARED.

Year.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
5	229	121,028	4,303	31	8,239	228	15	5,343	212	275	134,610	4,743
6	244	161,154	5,058	21	6,040	147	26	9,002	269	291	166,196	5,474
7	165	106,615	3,500	24	6,340	166	42	13,741	412	231	126,696	4,168
8	195	124,883	4,086	19	4,911	123	26	9,080	236	240	138,874	4,445
9	175	129,654	4,079	31	11,067	258	12	8,016	164	218	148,737	4,501
0	244	155,659	4,505	31	14,207	327	24	10,202	240	299	180,008	5,072
1	204	138,598	3,730	41	22,007	506	31	15,335	351	276	175,940	4,587
2	217	136,666	3,166	39	15,497	370	31	14,962	321	287	167,125	3,857
3	153	85,815	2,245	32	8,925	210	24	9,413	231	209	94,153	2,686
4	178	104,462	2,688	27	8,831	176	15	6,488	158	210	119,781	3,022
5	185	112,936	2,970	33	10,251	249	21	9,393	221	239	132,580	3,440

COMMERCE.

Year.	Value of exports.		Value of imports.		Total commerce.	Duties collected.
	Foreign.	Coastwise.	Foreign.	Coastwise.		
5	$209,791	$1,109,979	$14,304	$755,718	$2,089,792	$1,817 84
6	226,076	1,170,240	46,479	1,131,032	2,573,827	2,181 40
7	310,225	676,855	19,304	1,146,363	2,152,747	2,376 00
8	248,000	780,607	8,142	872,234	1,908,983	2,090 00
79	275,470	921,368	11,038	1,360,432	2,568,308	3,424 00
80	257,780	667,092	3,676	1,365,857	2,294,405	7,808 00
81	292,100	1,064,394	11,791	1,736,546	3,104,831	8,183 00
82	292,400	1,342,421	45,792	1,536,588	3,217,201	36,590 00
83	248,600	2,573,010	11,229	2,262,755	5,095,594	5,566 00
84	173,600	1,164,462	1,874	1,738,620	3,078,556	1,331 00
85	214,726	2,134,541	4,180	1,502,544	3,855,991	1,451 28

W. A. MAHONEY,
Collector

First Lieut. O. M. CARTER,
Corps of Engineers, U. S. A.

M 14.

IMPROVEMENT OF INSIDE PASSAGE BETWEEN FERNANDINA AND S JOHN'S RIVER, FLORIDA.

Appropriations for the improvement of this route, aggregating $7
were made at various times between the years 1828 and 1838. A fu
appropriation of $10,000 was made in 1874, and two others, of $
each, by the acts approved March 3, 1879, and June 14, 1880, respecti

Only $2,565.55 of the amount last appropriated had been expe
when the work was stopped.

As suggested in previous reports, the recently completed direc
of railway between Fernandina and Jacksonville and the improve
of the bar at the mouth of Saint John's River afford passenger
freight a choice between transit by rail and transit by sea and riv
coasting steamers, and the necessity for continuing the improvem
this inside passage is therefore not urgent at the present time; sti
inside passage between Savannah and Jacksonville, which act
continues far into the interior of Florida by means of the Saint J
River, may be considered a valuable water route for many purposes
importance, in the case of the United States becoming involved i
with a maritime power, has been pointed out in former reports. It
provement, when undertaken, should be on a liberal scale.

The following appropriations have been made for this work since

By act of Congress approved June 23, 1874	$
By act of Congress approved March 3, 1879	
By act of Congress approved June 14, 1880	
Total	

The total expenditures since 1874, including the cost of survey,
$19,565.55.

This inland route is partly in the collection district of Fernandina, and pa
that of Saint John's, of which Fernandina and Jacksonville are the respective
of entry.

Money statement.

July 1, 1885, amount available	$4,
July 1, 1886, amount available	4,

APPENDIX N.

IMPROVEMENT OF RIVERS AND HARBORS IN THE STATE OF FLORIDA.

REPORT OF LIEUTENANT WILLIAM M. BLACK, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. **Saint John's River, Florida.**
2. **Upper Saint John's River, Florida.**
3. **Volusia Bar, Florida.**
4. **Tampa Bay, Florida.**
5. **Apalachicola Bay, Florida.**
6. **Suwanee River, Florida.**
7. **Key West Harbor, Florida.**
8. **Pease Creek, Florida.**
9. **Harbor at Cedar Keys, Florida.**
10. **Manatee River, Florida.**
11. **Caloosahatchie River, Florida.**
12. **Apalachicola River, Florida.**
13. **Withlacoochee River, Florida.**
14. **Removing sunken vessels or craft obstructing or endangering navigation.**

UNITED STATES ENGINEER OFFICE,
Jacksonville, Fla., July 28, 1886.

GENERAL: I have the honor to transmit herewith my annual reports upon the works of river and harbor improvement under my charge for the fiscal year ending June 30, 1886.

Very respectfully, your obedient servant,

W. M. BLACK,
First Lieut. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

N 1.

IMPROVEMENT OF SAINT JOHN'S RIVER, FLORIDA.

Operations for improving the channel over the bar at the mouth of the Saint John's River, Florida, during the past fiscal year were carried on from the beginning of the year until September 23, 1885. The work was done under contract, and in accordance with the larger of two projects submitted to the Chief of Engineers by the officer then in charge, June 30, 1879, and printed as part of Appendix 17, Annual Report of the Chief of Engineers for 1879.

PROJECT OF IMPROVEMENT.

"The plan of improvement essentially consists in the constructio two low jetties, built of riprap-stone, supported by a foundation m tress or platform of logs, with a mattress hearting, wherever found p ticable, to reduce the cost of the work.

Of the two plans discussed, which differed from each other in m nitude and probable effects, the more comprehensive one has b adopted. This plan provides for the construction of two long jett starting from the opposite shores of the entrance and extending ward across the bar. It was intended thereby to establish a mid-ch nel depth of 15 feet at mean low water. The usual available low-wa depth over the bar in its unimproved condition was 6 feet, more or l with a mean rise and fall of tides of about 5 feet. The cost of this p ect was estimated at $1,306,409.

In order to secure the full benefit of an increased low-water depth the bar, as contemplated by the project, it will be necessary to impr some defective reaches of Saint John's River between the bar and t city of Jacksonville, the cost of which has been approximately estima at $120,000.

These additional works are considered to be properly the subject a special project and appropriation. If it should be finally decided include them under the general head, "Improvement of Saint Joh River," the estimate of the cost of the project given above must correspondingly increased.

Since the adoption of the existing plan of improvement of June 1879, four appropriations have been made by Congress for the wo aggregating $525,000. Previously an aggregate sum of $57,476.28 expended in dredging for the temporary improvement of the bar ch nel since 1865.

For making the preliminary surveys and preparing the project, sum of $2,523.74 was expended."

SUMMARY OF OPERATIONS PRIOR TO JUNE 30, 1885.

South jetty.—The foundation course or apron was laid to an aggreg length of 6,715.4 feet. Of this, the shore branch is 874 feet long, w a bearing of N. 46, 45 E. The main line begins at a point 70 feet b from the outer end of the shore branch and runs as follows, viz:

	1
Range 2 N., 74° 54′ E	3
Range 3 N., 75° 54′ E	
Range 4 N., 77° 41′ E	
Range 5 N., 79° 41′ E	
Range 6 N., 81° 41′ E	
Range 7 N., 83° 41′ E	
Range 8 N., 85° 41′ E	

On ranges 1, 2, 3, and a part of 4 the width of apron varies from 2 87 feet. In ranges 5, 6, 7, and 8 the width was increased to from to 120 feet, on account of the rapid current already developed along axis of the jetty. In all the apron is covered with from 12 inches t inches of stone. At different points along the second range the foll ing additional courses have been laid, viz: A second course, 3,209 long; a third, 2,729 feet long; a fourth, 1,544 feet long; a fifth, 1,317 long; a sixth, 903 feet long; a seventh, 127 feet long; an eighth, feet long, and a ninth, 40 feet long. In general the mattresses of course were eight feet narrower than those of the course below.

ght low spur-jetties were constructed, four on each side of the jetty, site to each other. They are located at distances of from 500 to feet, from the angle of the junction of the main line with the shore h. These spurs are formed of two courses of mattresses, the lower projecting from 81 to 98 feet beyond the edges of the apron of the line. Those laid on the north side are 75 feet wide, and those on outh side 100 feet wide. The original foundation course of the line was widened to arrest the destructive action of very strong nts, developed alongside of and across the work. A revetment or of mattresses, varying in width from 40 to 100 feet, beginning at w-water mark and extending 2,652 feet, was laid on the south side. foundation was still further broadened by placing a revetment or on the north side similar to that on the south. This revetment at the second spur from the shore and extended seaward a dis- of 1,703 feet, the width varying from 70 to 100 feet.

ween spurs 2 and 3, upon a length of 300 feet, there seems to be tability than in the rest of the jetty. Here the greatest settle- has taken place, and as it had been built up as a wall with steep it was further strengthened by a sort of buttress composed of log esses and riprap-stone, in all respects similar to the construction jetty. This buttress leans or abuts against the jetty for a distance out 120 feet, parallel to the axis, and is formed of six courses of esses, the lower course being 35 feet wide and the top course 14

holding the mattress work in place and in building up the south the amount of riprap stone employed from the beginning of oper- to June 30, 1885, aggregated 66,344.5 cubic yards.

th jetty.—The total length of this jetty in place was 2,617.5 feet. rest end was extended shoreward 908 feet during the fiscal year '85, to fill a channel which had threatened to form around it. The consists of a single course of mattresses 42 to 100 feet wide, covered m 9 inches to 12 inches of stone, with its axis on a single range ng S. 73 E.

to June 30, 1885, the total expenditures for both jetties, including nding liabilities, were $494,074.05.

ERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

July 1, 1885, the balance on hand available for work was $30,925.95[*] erations were continued under the contract with Mr. A. Ames How- f Syracuse, N. Y., as stated in the Annual Report for 1885, at 75 per square yard for mattresses and $3.10 per cubic yard for stone. nattresses were of the style described as "first design" in that re- Work was discontinued September 23, 1885.

th jetty.—Twenty-eight and ninety-three one-hundredths cubic of stone were placed on low parts of the jetty.

rth jetty.—Fourteen mattresses, with an aggregate length of 1,339 nd a width of from 50 to 100 feet, were placed in the line of the to which must be added 374 feet of shore protection. These were sted with 3,910.98 cubic yards of stone.

June, 1886, the annual survey of the bar was made by Mr. A. W. er, assistant engineer.

m the commencement of the fiscal year the work was under the e of Capt. W. T. Rossell, Corps of Engineers, until he was relieved e April 26, 1886, by virtue of paragraph 2, Special Orders No. 89, quarters of the Army, Adjutant-General's Office, Washington, 16, 1886.

CONDITION OF THE WORK JUNE 30, 1886, AND EFFECTS ON THE B

The south jetty has a length of 836 feet completed to an aver height of 2 feet above mean low water, and a total length of 6,715 feet.

The north jetty has a length of 374 feet, with an average heigh 18 inches above mean low water, and a total length of 4,330.74 feet.

A comparison of the survey of 1886 with that of 1885 shows the lowing changes in the lines of the river and ocean :

South of the river the high-water line shows a more regular c than it had last year. In the vicinity of the jetty it has receded a 140 feet, but is 75 feet outside the shore end of the jetty. Two thous five hundred feet below the jetty it has pushed out about 150 feet. low-water line on the south shore is practically unchanged.

On the north shore the high-water line has also receded. F Haulover Creek to the river the average amount of recession is 50 f from this point for 2,500 feet it is 250 feet, and near Fort George Inle feet. The shore end of the north jetty is now 200 feet outside high-w mark. The low-water line is practically unchanged, excepting at I George Inlet, where a large bank has made out from the shore.

The changes in the area inclosed by the 6-foot curve of the bar very marked. This area formerly extended from the north shore ac the jetty lines to the old ship-channel. It is now divided into t distinct parts, one south of the south jetty, one between the jet and the third north of the jetties.

The first is increasing, and apparently will cross the old ship-cha as soon as the sailing gap in the south jetty is closed.

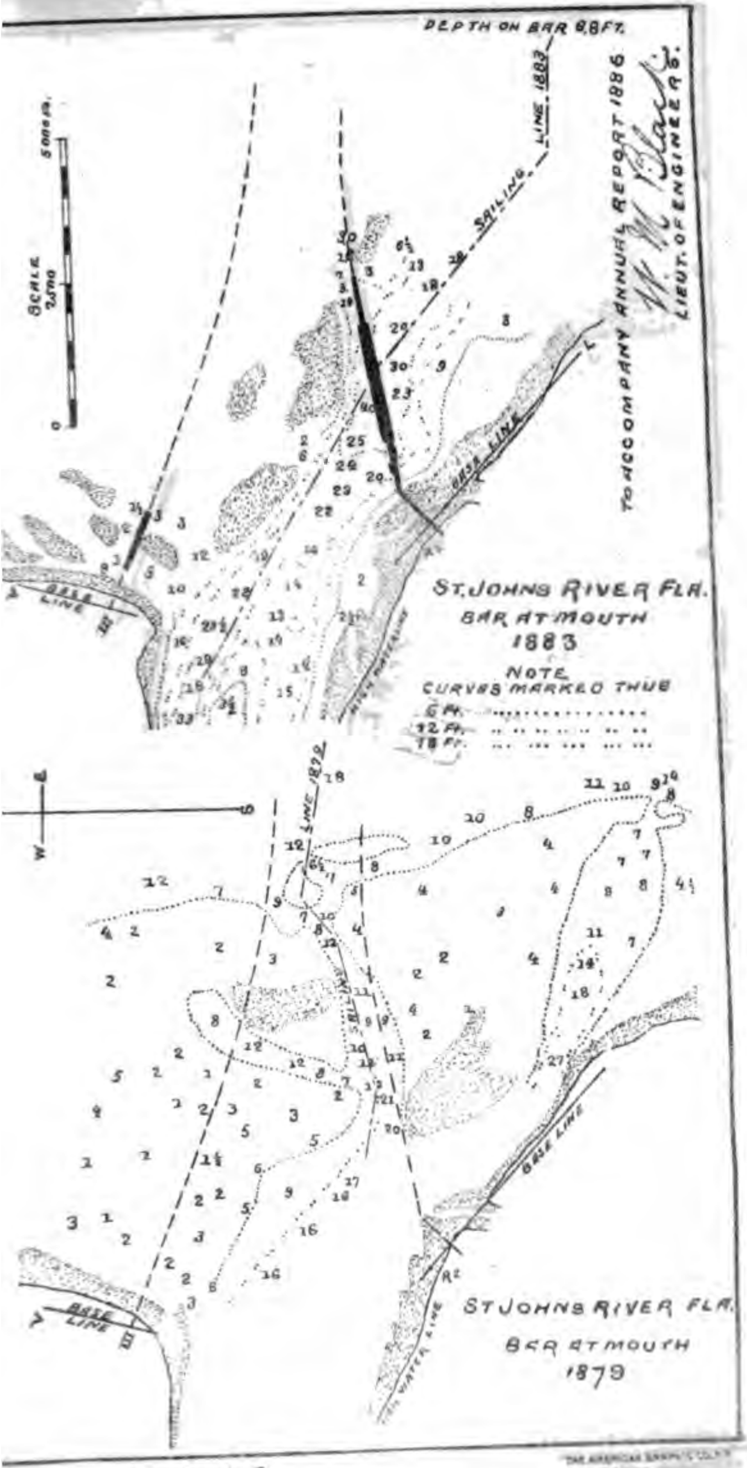
The second lies across the jetty entrance, is bounded on the south the new jetty channel and on the north by a channel running no east across the end of the north jetty to deep water. This portio very powerfully acted upon by what may be called the jetty curre Its present tendency is to cut out on the north side and build up on south, and it will all be moved eventually to make room for the j channel.

The third part is forming and protects the north jetty from the no east storms.

In the present stage of its construction, the north jetty, while it p tects somewhat the mouth of the river from encroachments of s from the north, does not extend far enough to have much influenc the ebb currents from the river. It therefore assists in their const tendency to straighten the channel at the river mouth, without prop directing them after passing that point. There is consequently a str tendency to cut new channels across the line for the jetty extens eroding the bottom and greatly increasing the height required for completed work and its consequent cost. If work cannot soon be d here these false channels may even be a source of great injury to the s entrance.

The 12 and 18 foot curves on the outer slope of the bar seem to h been pushed slightly seaward. The 24 and 30 foot curves follow general trend of the coast.

The profile of the south jetty shows an average settlement of fro inches to 2 feet, probably caused by the partial destruction of the m tress hearting by the teredo. It has not been expected that this he ing could be preserved above the general sand-level. Beyond the sh extensions this may be expected to be, on the channel side of the jett at a depth nearly equal to the hydraulic mean radius of the impro



ST. JOHNS RIVER FLA.
BAR AT MOUTH
1883

NOTE
CURVES MARKED THUS
6 FT. ....
12 FT. .. ..
18 FT. ... ...

ST JOHNS RIVER FLA.
BAR AT MOUTH
1879

TO ACCOMPANY ANNUAL REPORT 1886.
W. M. Black
LIEUT. OF ENGINEERS.

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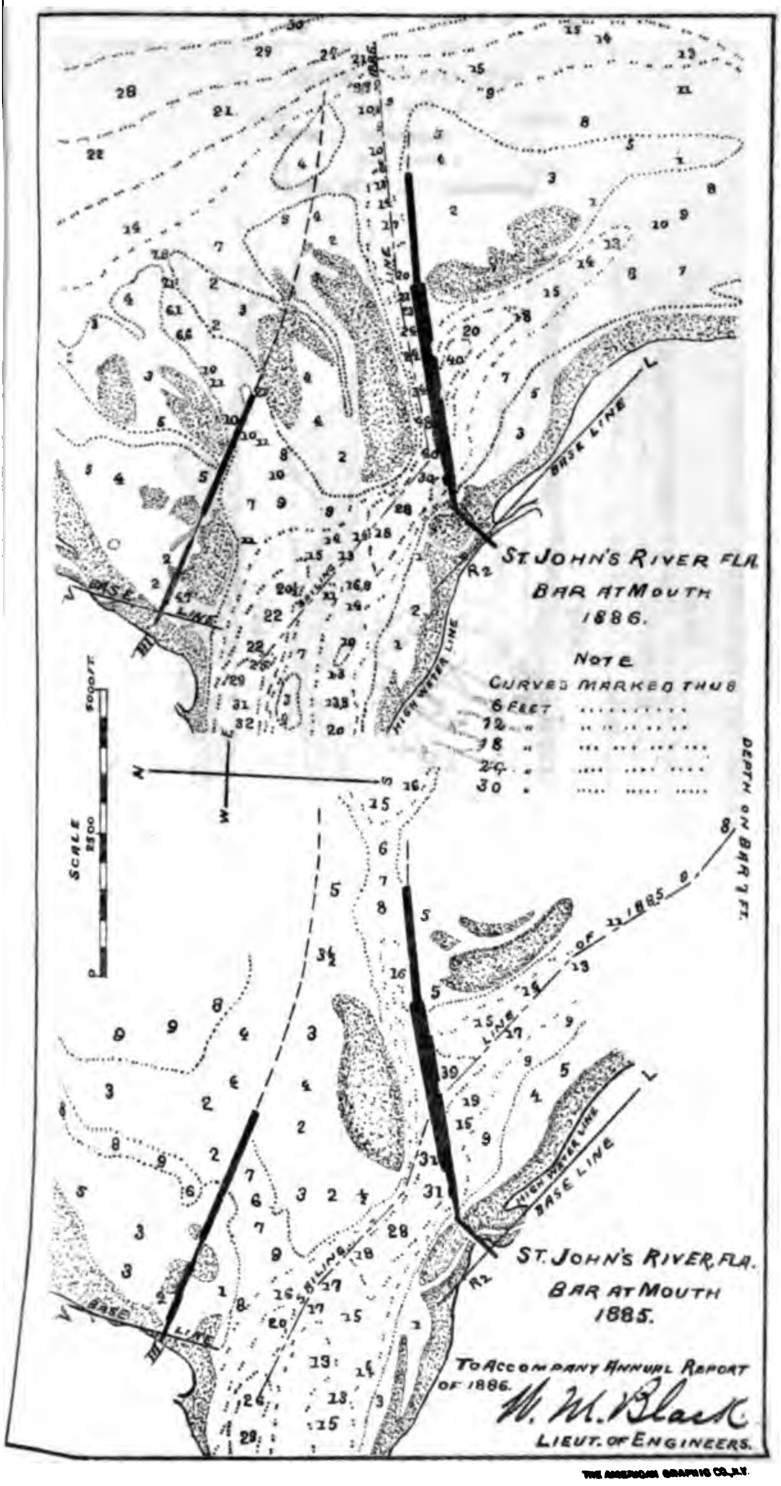

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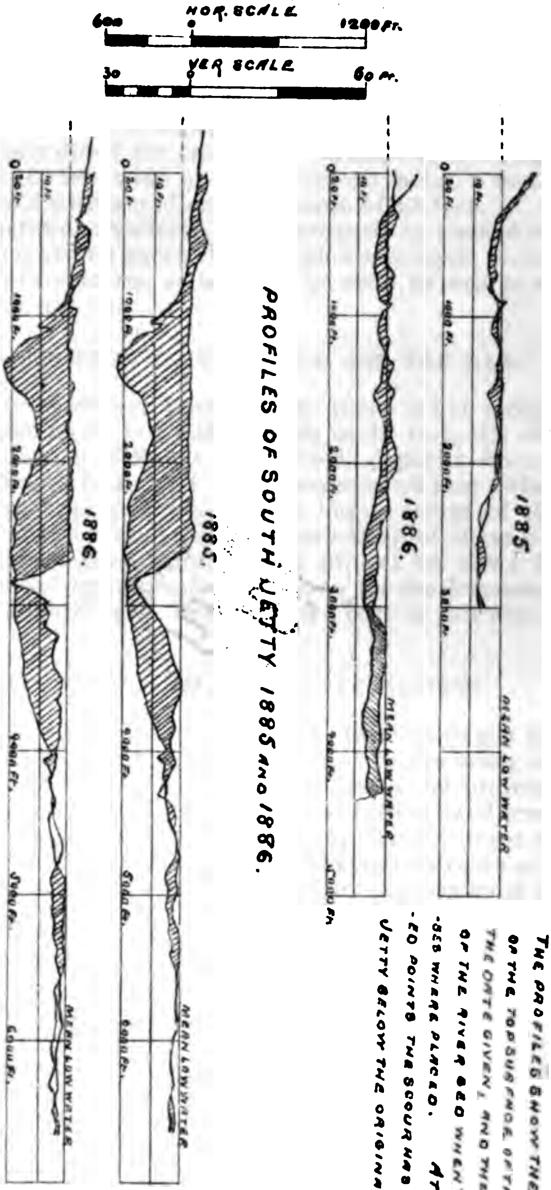
ST. JOHNS RIVER, FLA.

BAR AT MOUTH



PROFILES OF NORTH JETTY 1885 AND 1886.

PROFILES OF SOUTH JETTY 1885 AND 1886.

NOTE.

THE PROFILES SHOW THE POSITION OF THE TOP SURFACE OF THE JETTY AT THE DATE GIVEN, AND THE POSITION OF THE RIVER BED WHEN THE MATTRESSES WERE PLACED. AT THE UNSHADED POINTS THE SCOUR HAS SUNK THE JETTY BELOW THE ORIGINAL RIVER BED.

TO ACCOMPANY ANNUAL REPORT OF 1886.

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nnel. This consideration would limit the use of the wood-hearting laces where the present mean low-water depth exceeds 11 feet. At ther points it would seem best to use nothing but stone above the ress foundation. At present the jetties are sanded up to their full ht as far as the shore 6-foot curves.

the north jetty both ends have been cut out by storms. No other ement is observable.

e jetty channel has been used by vessels since March, 1886. Its n has varied from time to time, the jetties not being far enough ad- ed to sufficiently direct the currents. On June 30 there was across ar a channel 400 feet wide at its narrowest point, 8 feet deep at low water, and with a mid-channel depth of 8.8 feet.

ould there be funds available, it is proposed to extend and raise orth jetty, to move its shore end to high-water mark, properly pro- ng it from future storm action, and as soon as safe to close the g gap in the south jetty.

SHOALS BETWEEN JACKSONVILLE AND THE BAR.

e latest charts show four points where there is not a continuous nel with a least mean low-water depth of 15 feet, viz, at Dame's t, below the mouth of San Carlos Creek, opposite Saint John's , and below Marsh Island. I would recommend that either a por- of the general appropriation for the improvement of the Saint 's River be made available for an examination of these points for urpose of preparing an estimate and project for their improve- , or that a special appropriation be made for the improvement of ower Saint John's River. The estimated cost of this examination ,500.

NECESSITY FOR AN EARLY APPROPRIATION.

would seem unnecessary again to invite attention to the yearly in- e of the cost of the completed work caused by the many interrup- and delays in its construction. In addition to the ordinary dete- tion of all unfinished work, jetties built on shifting sand are subject nditions which in the interests of economy demand most urgently pt action. The scour of the partially directed currents across the of the jetties deepens the water through which they must be built, thus directly increases their cost. The final sanding up is pre- ed and their permanency endangered. As an instance, in the h jetty extension the material now required is fully twice what d have been needed could the jetty have been built one year ago. e conditions become more marked as the jetties approach comple- and as the forces they produce become more powerful. In addition ese engineering necessities are the calls from the commercial inter- For these I would respectfully invite attention to the statements e appended letter from the secretary of the Jacksonville Board of e. I would earnestly repeat the recommendations of my prede- rs that in the interests of economy an early appropriation be made arrying on the work.

s improvement is located in the collection district of Saint John's. Jacksonville nearest port of entry. Nearest light-house is Saint John's River Light. Near- rt is Fort Clinch. Amount of duties collected in fiscal year 1886, $2,398.28.

The following appropriations have been made for this work since present project of improvement was adopted:

By act of Congress approved June 14, 1880	$12
By act of Congress approved March 3, 1881	10
By act of Congress passed August 2, 1882	1
By act of Congress approved July 5, 1884	1
Total	5

The total expenditures to June 30, 1886, including outstandin bilities, were $523,065.72.

The following papers accompany this report:

1. Map of mouth of river. Scale $\frac{1}{5000}$.
2. 3. Comparative maps mouth of river 1879, 1882, 1885, 1886. Scale, $\frac{1}{15000}$.
4. Profiles of jetties, 1885, 1886.
5. 6. Commercial statistics.

Money statement.

July 1, 1885, amount available		$30,
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$28,339 33	
July 1, 1886, outstanding liabilities	652 34	
		28,
July 1, 1886, amount available		1,
Amount appropriated by act approved August 5, 1886		150,
Amount available for fiscal year ending June 30, 1887		151,
Amount (estimated) required for completion of existing project		631,
Amount that can be profitably expended in fiscal year ending June 30, 1888		600,

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, JACKSONVILLE, FLA.,
Collector's Office, July 17, 1

SIR: Inclosed please find information asked for in your letter of the 19th ult
Very respectfully, your obedient servant,

JOSEPH E. LEE,
Deputy Coll

W. M. BLACK,
First Lieutenant of Engineers.

Port of Jacksonville, Fla.

ARRIVED.

Class, tonnage, &c.	Coastwise.		Foreig	
	June 30, 1884, to June 30, 1885.	June 30, 1885, to June 30, 1886.	June 30, 1884, to June 30, 1885.	J 1 J
Steamers	107	123	....	
Sailing vessels	221	228	20	
Total tonnage	114,919	119,280	1,978	
Total of crews	4,838	8,057	137	

CLEARED.

Class, tonnage, &c.	Coastwise.		Foreig	
	June 30, 1884, to June 30, 1885.	June 30, 1885, to June 30, 1886.	June 30, 1884, to June 30, 1885.	J 1 J
Steamers	112	115	....	
Sailing vessels	177	177	36	
Total tonnage	100,037	109,721	5,808	
Total of crews	4,091	4,407	245	

Port of Jacksonville, Fla.—Continued.

Value of exports and imports and duties collected.	June 30, 1884, to June 30, 1885.	June 30, 1885, to June 30, 1886.
Value of exports	$54,071 32	$42,241 55
Value of imports	35,876 54	72,007 60
Duties collected	473 86	2,398 28

LETTER OF THE JACKSONVILLE BOARD OF TRADE.

ROOMS OF THE JACKSONVILLE BOARD OF TRADE,
Jacksonville, Fla., July 14, 1886.

DEAR SIR: In response to your request to Col. J. J. Daniel, president of this board, which was referred to me, I have the honor to submit the accompanying statements, which have been carefully compiled by the statistical committee of the Board of Trade.

Hoping the information will be of value to you in your report, I have the honor to be, with high regards,

Yours, most respectfully,

JAMES M. FAIRLIE,
Secretary.

W. M. BLACK,
First Lieutenant of Engineers, U. S. A.

THE COMMERCIAL INTERESTS OF JACKSONVILLE, FLORIDA.

Saint John's Bar commerce for one year, from January 1, 1885, *to December* 31, 1885.

Vessels entered	466
Vessels cleared	374
Net tonnage of vessels arriving and departing (tons)	264,004
Estimated value of vessels and cargoes	$34,592,312
Upon this amount shippers are required to pay increased insurance over that of the neighboring ports, caused by the risks in crossing the Saint John's Bar, from ⅓ to ⅔ per cent	225,687
Together with increased freight charges from the same cause, 50 cents per ton	178,772
The loss by delays, caused by the bad condition of the bar, 678 days	24,675
Damage to vessels and cargoes on the bar	6,250
Estimated loss to commerce by not having a good harbor of refuge at the mouth of the Saint John's River, made by underwriters' agent	100,000
Gross burden on the commerce of the city of Jacksonville during the year 1885, which the completion of the improvements on the bar would have saved	535,384

LUMBER SHIPMENTS.

The total number of feet of sawed lumber shipped from the port of Saint John's (Jacksonville) during the year 1885 was	40,271,150

Saint John's Bar commerce for five years, from January 1, 1880, *to December* 31, 1884.

Vessels entered	1,882
Vessels cleared	1,897
Net tonnage of vessels arriving and departing	1,250,897
Estimated value of vessels and cargoes	$172,405,641

Upon this amount the increased insurance over that of other neighboring ports, caused by risks of this bar, is from ¼ to ¾ per cent	1,13
The increased freight charges from the same cause average 50 cents per ton	57
The loss by delays, caused by the bad condition of the bar, 4,500 days	16
The loss of vessels and merchandise on the bar	9
Loss to commerce by not having a good harbor of refuge in this river, estimated by underwriters' agent at $100,000 per annum	50
Total burden on the commerce of Jacksonville in the last five years, which the completion of the improvements on the bar would save	2,46

LUMBER SHIPMENTS.

Feet of sawed lumber shipped in five years, from January 1, 1880, to December 31, 1884	258,79

Value of exports and imports and duties collected.

Year.	Value of exports.	Value of imports.	Duti lec
1878	$74,085 00	$1,363 27	
1879	92,890 00	15,319 26	
1880	94,680 00	888 40	
1881	62,265 00	2,380 08	
1882	68,583 00	12,542 51	4,
1883	45,120 86	4,038 28	
1884	44,368 52	29,196 77	

Lumber shipped from the port of Jacksonville, Fla., for the year ending December 31, 1885, to domestic ports was	feet	36,53
To foreign ports	do	2,11
Besides this there was shipped to domestic ports red cedar lumber	do	3
Red cedar logs	do	
Laths		1

One car load of pine-knots.

COMMERCIAL INTERESTS OF JACKSONVILLE.

The population of Jacksonville is steadily increasing. The city and suburban lation in 1878 was 12,170, in 1880 was 13,470, in 1882 was 15,904, in 1884 was 1 in 1886 was 21,589.

The total number of buildings in the city of Jacksonville are 4,281. There manufacturing establishments, 471 mercantile buildings, 20 hotels, 100 private ing houses, 11 livery stables, 5 machine-shops, 45 warehouses for storing go foundries, 4 boiler works, 6 freight depots, 4 brick-yards, 5 ship-yards, 3 marin ways, 7 large saw-mills and 8 shingle and wood mills, 1 opera-house, 17 public 39 churches, 14 school-houses, 21 cigar factories, 3 ice factories, 3 wagon and ca establishments. There are 102 grocers and provision merchants, with 342 emp whose combined business aggregated, during 1885, $3,056,422.10. Eight grain and flour merchants, with 80 employés, handled merchandise valued at $1,354,0

Twenty-one produce and commission merchants, with 87 employés, sold good ing last year to the value of $606,000.

The other branches of business are represented as follows:

18 fruit and confectionery stores, 43 employés	$
6 hardware and building-material stores, 125 employés	9
18 dry-goods houses, 209 employés	1,8
5 boot and shoe stores, 39 employés	2
7 furniture stores, 61 employés	21
2 musical instruments, 17 employés	
8 lumber mills and naval stores, 750 employés	1,0
3 book stores, 19 employés	11
16 drug stores, 57 employés	1
3 earthenware stores, 20 employés	
9 jewelry and curiosity stores, 66 employés	1

wenty-one cigar factories, 450 employés, consumed, in 1885, 110,400 pounds to-
;o; paid the internal-revenue collector $13,152 in stamp taxes, and made 5,060,025
rs, valued at $200,000.
our brick-yards, 35 employés, produced 10,500,000 brick, valued at $94,500.
hree wagon and carriage establishments, with 26 employés, $40,000.
his is only a partial record of the business done in Jacksonville. When business
he railroads, the shipping companies, the machine and boiler shops, the ship
ding and repairing, iron working and castings, harness, ice factories and dealers,
e and terra-cotta works, fertilizers, palmetto goods, brushes, &c., is considered the
of $20,000,000 will be a small estimate of the actual business done in the city.

REAL ESTATE.

1e assessed value of real estate has increased from 100 to 300 per cent. in the last
teen years. In 1873 some of the best corner lots in the city were offered for sale
om $500 to $1,000 per lot, of 105 feet front and running back to the river. These
e lots are now valued at and sold for $1,000 per foot front; while the property in
r parts of the city and in the suburbs has increased in a proportionate ratio.

RAILROAD BUSINESS.

1ere are now ready nearly 2,000 miles of railway in operation in the State of
ida, every mile of which has direct connection with one or the other of the six
ways which center at Jacksonville or with the great tributary, the Saint John's
r.
eight handled during 1885:

ard freights	tons..	214,029
ward freights	do...	36,274
Total		250,303
1ge shipments by rail	boxes..	403,157
1ge shipments by steamers	do...	123,481
Total		526,638
etable shipments	crates..	200,000
wberry shipments	do...	200,000
ments of fish and oysters valued at		$65,000

1e entire crop of oranges in Florida during 1885 was nearly 1,000,000 boxes. It
thus be seen from the above statement that fully one-half the Florida freight
ness is at present tributary to Jacksonville as the port of the Saint John's River.
1e amount paid by the Jacksonville merchants during 1885 for eastern freights
lusively was $241,079.77.
essrs. C. H. Mallory & Co., of New York, agents for the Mallory line of Texas and
ida steamships, in a letter to the Jacksonville Board of Trade under date of
ember 16, 1885, states that if there were 16 feet of water on the Saint John's Bar
r would put on a line of steamers between New York and Jacksonville "that
ld be equal to any flying the flag of the United States."
, therefore, Jacksonville handles more than half the freight coming into and going
1 the State with the present want of transportation and shipping facilities over
bar, it is safe to say that with the bar deepened and from two to six steamers per
k entering the port from coastwise ports, besides the impetus that would at once
iven the export and import business with the West Indies and other points, Jack-
rille would undoubtedly do much more of the freight business than all the other
s in Florida put together.

N 2.

IMPROVEMENT OF THE UPPER SAINT JOHN'S RIVER, FLORIDA.

3y the river and harbor act approved July 5, 1884, the sum of $5,000
3 appropriated for improving the Upper Saint John's River, Florida.
s is the first appropriation ever made by Congress for this work.

The part of the Saint John's River referred to in the act is presumed to be that portion extending from Lake Monroe to the head of Lake George, a distance by river of about 45 miles. An examination of this section was made in the early part of the year 1879, report of which, dated July 16, 1879, with a project of improvement, is printed as Appendix I 9, Annual Report of the Chief of Engineers for 1879. It was stated in that report that the stream, although very crooked, is of ample depth for any class of vessels adapted to the navigation of the Upper Saint John's River, and that the only gain to be secured by cut-offs is strictly in distance. It was suggested to confine the work of improvement to cutting off the four most prominent bends, located as follows:

(1) A bend three-fourths of a mile above Old Town, 25 miles below Lake Monroe.

(2) Two bends about 2 miles below Manuel's Landing, 7½ miles below Lake Monroe.

(3) A bend at Manuel's Landing, 5½ miles below Lake Monroe. The results of a later examination of the same section of the river, made in conformity to a provision in the river and harbor act passed August 2, 1882, did not differ from the conclusions previously reached.

Pursuant to instructions from the Department, another report was submitted October 5, 1883, with revised plans and estimates.

The width of the river at the bends named varies from 130 to 150 feet, and in the reaches connecting them from 150 to 200 feet. The banks and adjoining ground average 4 feet above water-surface at low-river stage. The plan of improvement contemplates cut-offs 100 feet wide at the bottom, side slopes 1 on 1, and a low-river depth in the cuts of 6 feet. This depth was adopted as being the maximum low-river depth at the shoalest places between Little Lake George, 20 miles below the head of Lake George and Lake Monroe.

Two estimates were submitted, one for straight cut-offs and the other for curved cut-offs with quite easy curves so as to offer no obstruction to navigation. The work would principally consist of dredging, but a few light closure dams would have to be built and some grubbing done. The estimated cost of this improvement is $43,000 for straight cut-offs, and $38,800 for curved cut-offs. The latter system has been adopted.

The appropriation available being small, it was proposed to begin operations by opening the shortest cut, that at Old Town. Proposals for this work were invited, to be opened October 24, 1884. No bids were received.

Under these circumstances, with the approval of the Chief of Engineers, it was decided to await further appropriations before beginning the work.

This part of the river is passed over by steamboats about twelve times per day.

From the beginning of the fiscal year the work was under the charge of Capt. W. T. Rossell, Corps of Engineers, until he was relieved by me April 26, 1886, in accordance with Special Orders No. 96, paragraph 2, Headquarters of the Army, Adjutant-General's Office, Washington, April 16, 1886.

The balance available and the appropriation asked for are to be used in accordance with the approved project.

This work is located in the collection district of Saint John's. Jacksonville is the nearest port of entry. Nearest light-house is Dame's Point Light. Nearest fort is Fort Marion. Amount of duties collected in fiscal year, $2,398.28.

Money statement.

1885, amount available	$4,979 21
1886, amount expended during fiscal year, exclusive of liabilities anding July 1, 1885	4 05
1886, amount available	4,975 16
int (estimated) required for completion of existing project	33,800 00
int that can be profitably expended in fiscal year ending June 30, 1888	33,800 00
iitted in compliance with requirements of section 2 of river and bor acts of 1866 and 1867.	

N 3.

IMPROVEMENT OF VOLUSIA BAR, FLORIDA.

rations for improving Volusia Bar, Florida, have been carried on rvals since December, 1880. Four appropriations have thus far nade by Congress for its improvement previous to the current rear, aggregating $17,500.

isia Bar is located at the south end or head of Lake George, about iles by river from the mouth of the Saint John's River, at the point the waters of the river flow into the lake.

lve steamboats pass this point daily, having a total tonnage of 5,130 tons.

examination of Volusia Bar with a view to its improvement was in March, 1879. A report thereon, dated July 16, 1879, with plan rovement, is printed as Appendix I 9, Annual Report of the Chief gineers for 1879.

was modified as reported in the Annual Reports of the Chief of eers for 1882 and 1883, Appendix J 11 and L 14, respectively.

PROJECT OF IMPROVEMENT.

consists of the narrowing of the channel by two converging and stone jetties, starting from the shore and extending to the 6- rve in the lake, and with such width between the ends as will ain a channel-depth of 6 feet at low water, where before improve- he depth was 3½ to 4½ feet. The channel is to be further defined uarded by rows of fender-piles. Dredging is to be resorted to if ary to obtain the required depth.

estimated cost of the revised project is $25,000.

estimated that about 12,000 cubic yards of material should be ed by dredging.

OPERATIONS TO JUNE 30, 1885.

west jetty, built on a straight line bearing north 25 degrees west, ached a length of 2,206 feet from shore. For the greater part it ied of a single course of pole and brush mattresses from 6 to 12 ide, loaded with broken stone. A second course of 6-foot mat- s covers 159 linear feet of the outer portion of the jetty.

shore-end of the east jetty is about 2,400 feet east of the west It is built on lines by which it gradually converges toward the vork in approaching the bar. Its aggregate length is at present

3,459 feet. From the shore it extends 1,836 linear feet on a range bea north 76 degrees west; the next length of 1,100 feet bears north 63 grees west, and the remainder, which is located upon the bar, about parallel to the opposite part of the west jetty, and 240 feet it. It generally consists of a single course of mattresses from 6 feet wide, covered with riprap-stone, except for 247 feet length at bar, where a second course was put on.

One hundred and fifty fender-piles were driven on the bar, nearly in clusters of three and four, in two rows 75 feet apart. Each row tends over a length exceeding 800 feet, and runs about parallel to west jetty. The row nearest to that work is 100 feet from it. At beginning of the fiscal year, July 1, 1884, all of these piles had be broken or knocked down. In this condition they formed a serious struction to navigation.

In 1885 the broken piles were removed. New piles were driven clusters, and securely fastened with chains. The width between ro was increased to 100 feet, and the piles were increased in size. Sto was placed on low spots on east jetty.

OPERATIONS DURING THE PAST FISCAL YEAR.

The appropriation having been nearly exhausted, no operations we carried on during the year.

From the commencement of the fiscal year, the work was under t charge of Capt. W. T. Rossell, Corps of Engineers, until he was relie by me, April 26, 1886, in accordance with Special Order No. 89, pa graph 2, Headquarters of the Army, Adjutant-General's Office, Wa ington, April 16, 1886.

THE EFFECTS OF THE WORK AND CONDITION GENERALLY.

Although settlement has taken place along both jetties, they are s in good condition and have sanded up along the whole length.

On June 30, 1886, 121 out of the 158 piles driven in 1885 were s standing. A uniform depth of 5 feet 8 inches existed throughout t channel.

Since the work of improvement was commenced, the following propriations have been made:

By act of Congress approved June 14, 1880	$5,
By act of Congress approved March 3, 1881	5,
By act of Congress passed August 2, 1882	5,
By act of Congress approved July 5, 1884	2,
Total	17,

Of this amount the sum of $17,340.26 has been expended to June 1886.

The balance available and the appropriation asked for are to be u in raising and extending the jetties, in keeping the fender-piles up, in dredging if necessary.

This work is in the collection district of Saint John's; Jacksonville is the nea port of entry. Nearest light-house is Dame's Point Light. Nearest fort is Marion. Amount of revenue collected in 1886, $2,398.28.

Money statement.

5, amount available		$162 49
6, amount expended during fiscal year, exclusive of ties outstanding July 1, 1885	$2 75	
6, outstanding liabilities	12 00	
		14 75
6, amount available		147 74
ppropriated by act approved August 5, 1886		7,500 00
ailable for fiscal year ending June 30, 1887		7,647 74

COMMERCIAL STATISTICS.

[General offices De Bary Baya Merchants' Line, Saint John's River steamers.]

JACKSONVILLE, FLA., *June* 24, 1886.

R: In reply to yours of 19th instant relative to number of vessels passing e Upper Saint John's, amount of tonnage, &c., I beg to send you the fol- e same being as nearly as I can come to the facts:

steamers from Jacksonville	4
steamers from Palatka	2
l	6

uld amount to 12 boats passing daily, as the trips were made both up and

unt of tonnage is about 5,130 tons.
that the above may prove of service to you,
n, respectfully, yours,

H. T. BAYA,
General Manager De Bary Baya Merchants' Line.

V. M. BLACK,
United States Engineers.

N 4.

IMPROVEMENT OF TAMPA BAY, FLORIDA.

a Bay is a large indentation in the Gulf coast of Florida, with age width of from 6 to 7 miles, and a length including Hills- and Old Tampa Bay, into which its inner end is divided, of 35 Across the bar and up to the point of division, a distance of 25 e channel has a depth of from 20 to 38 feet.

ampa Bay, the northwestern division, is about 10 miles long, average width of 5½ miles. Near its mouth there is a channel over 20 feet of water. A depth of 10 to 12 feet extends to its Hillsborough Bay has an average width of 5 miles, with depth from 16 feet at the mouth to 8 feet near head. Flats with low- epth from 1 foot to 5 feet, varying in width from one-fourth to 1 rround the entire body of water.

incipal tributary is the Manatee River. The principal town is lying at the mouth of the Hillsborough River, at the head of ough Bay, but separated from the deep water of the bay by a at, through which runs a narrow channel formed by the waters borough River. This, before improvement, permitted vessels 8 feet of water to reach Tampa only by taking advantage of es.

Tampa is the terminus of the South Florida Railroad, which tl forms connection with the steamship lines for Key West, Havana, New Orleans. The South Florida Railroad gives by its connection present a through line to the North, East, and West by the Saint Jo River from Sanford, the eastern terminus. Other railroads are jected to Tampa.

An examination of Tampa Bay, with a view to its improvement, made in 1879. A report thereon, dated August 25, 1879, with a of improvement, is printed as Appendix J 18 to the Report of the C of Engineers for 1879.

PROJECT OF IMPROVEMENT.

The proposed improvement consists in deepening and widening channel from Tampa to the bay, by dredging and rock excavatio as to give a clear depth of 9 feet at mean low water, and a widt the river of 200 feet and in the bay of 150 feet, a total distance miles.

OPERATIONS TO JUNE 30, 1885.

The following appropriations have been made by Congress:

By act approved June 14, 1880	$1
By act approved March 3, 1881	1
By act passed August 2, 1882	2
By act approved July 5, 1884	[illegible]
Total	[illegible]

The work has been done by contract.

On June 30, 1885, a channel generally 60 feet wide, 9 feet deep at low water, 8,215 feet long through the bay, and 150 wide, with depth, through the ledge at the mouth of the Hillsborough River, w ported to have been dredged. This, however, was obstructed by sl at various points, notably at two places below Spanish Town Point for about 1,000 feet above Spanish Town Creek, where the deptl only 7½ feet. The channel had also narrowed at many places.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1886.

Dredging was continued by Mr. James E. Slaughter under the tract approved by the Chief of Engineers March 12, 1885, as rep in the last Annual Report. On August 14 work was suspended fo season.

The work done under this contract resulted in a channel from water of Hillsborough River towards the bay, 4,793 feet in lengtl varying in width from 45 to 150 feet, with an average depth of at mean low water; 28,093.73 cubic yards of mud and 1,200 cubic of stone were removed.

An examination made in May, 1886, showed the center line o channel but little changed. The sides of the cut had been crumbl by the wash of boats passing, and cross-currents had shoaled th slightly at one place.

To complete the channel according to the original project 18 cubic yards of material must be removed, at an estimated cost of $7

151,455 cubic yards mud, at 35 cents	$53,
2,000 cubic yards rock, at $4	8,
Engineering expenses and contingencies	12,
Total	73,

HEAD OF TAMPA BAY FLA.

(TAKEN FROM COAST SURVEY CHART Nº 77)

ING DREDGED CHANNEL AND PROPOSED TIDAL BASIN

STATUTE MILES

1 ¾ ½ ¼ 0 1 2 3 4

NOTE

DREDGED CHANNEL MARKED THUS ———

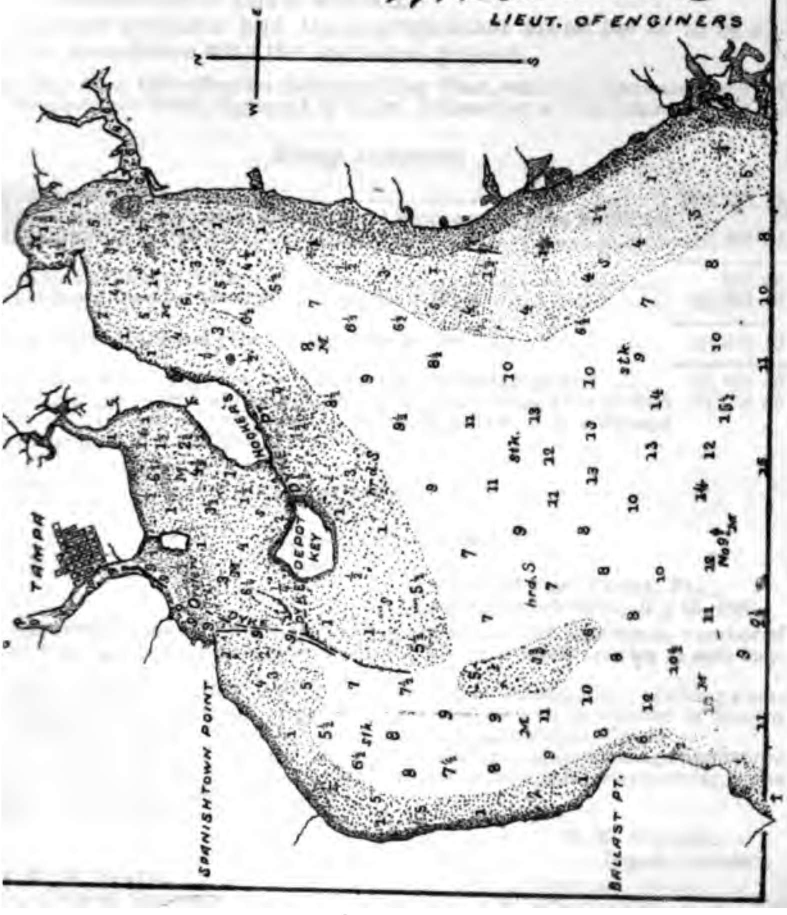
YKE AROUND TIDAL BASIN " " - - - -

OUNDINGS SHOW DEPTH IN FEET BELOW MEAN LOW WATER

TO ACCOMPANY ANNUAL REPORT FOR 1886

W. M. Black

LIEUT. OF ENGINEERS



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THE AMERICAN GRAPHIC CO.,N.Y.

s increase over the original estimate is caused by the constant
; of the dredged channel by action of the tides.
) permanency of the dredged channel can be insured by the for-
n of a tidal basin to be filled and emptied through it. This can
ne by building a dike, with top at level of mean high water, from
er's Point to Depot Key and thence west to the channel line, there
g a dike starting from the oyster-bed northeast of Spanish Town
and running parallel to the channel as far as the 9-foot curve.
, including the proper protection of Spanish Town Point, about
yards of dike would be required, of an average height of 3 feet.
idal basin thus formed would cover an area of 39,647,000 square
with a tidal prism of 652,476,343 gallons. The estimated cost of
if made of stone with mattress foundation, is $76,000.

5 cubic yards stone, at $3	$41,116 50
0 square yards mattress, at 70 cents	21,973 00
ering expenses and contingencies	12,617 90
Total	75,707 40

the depths are generally slight, a creosoted-wood dike would proba-
e strong enough and sufficiently permanent.
e estimated cost of this is $50,000.
e balance available and the appropriation asked for is to be ex-
ed in accordance with the approved project.

pa Bay is in the collection district of Key West, which is the nearest port of
Nearest light-house, Egmont Key Light. Nearest fort is Fort Jefferson, Florida.

Money statement.

, 1885, amount available	$12,198 50
, 1886, amount expended during fiscal year, exclusive of liabilities tanding July 1, 1885	11,368 04
, 1886, amount available	830 46
nt appropriated by act approved August 5, 1886	10,000 00
nt available for fiscal year ending June 30, 1887	10,830 46
unt (estimated) required for completion of existing project	63,000 00
unt that can be profitably expended in fiscal year ending June 30, 1888	50,000 00

mitted in compliance with requirements of section 2 of river and
arbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, TAMPA, FLA.,
Deputy Collector's Office, July 15, 1886.

: Herewith inclosed please find statement of number of passengers, number of
of baggage, and amount of duties collected from small articles in said bag-

paper headed "Commercial statistics of port of Tampa, Fla.," showing num-
vessels arriving coastwise, with total tonnage, as well as number of foreign
s arriving, *via* of Key West, at this port, with total tonnage of same.
pa is simply a port of delivery; hence all vessels coming from foreign ports must
nter at Key West, the port of entry, and proceed to this port under permit; hence
ort on duties on imports or exports.
Very respectfully,

T. K. SPENCER,
Deputy Collector.

t. W. M. BLACK,
Corps of Engineers.

Port of Tampa, Fla.

From October 31, 1885, to June 30, 1886.	Steamers.	Sailing vessels.	Total
Coastwise	100	16	582,
Foreign, by way of Key West	66	....	144,

Tabulated statement of arrivals of passenger steamers, passengers and baggage, and du collected thereon, for port of Tampa, Fla.

Period.	Total number of trips.		Total number of passengers carried.	Total number of pieces of baggage.	Duti collect on
	Lines.				
	Plant.	Morgan.			
From November 28, 1884, to May 1, 1885	12	11	305	545	[illegible]
From October 31, 1885, to June 30, 1886	40	26	1,142	2,279	2,1

N 5.

IMPROVEMENT OF APALACHICOLA BAY, FLORIDA.

Operations for the improvement of this bay were carried on during t past fiscal year in accordance with the project submitted to the Ch of Engineers, and published in the Annual Report for 1879, pages 8 and 824.

A bar existed at the mouth of the river, extending from half a m below the town of Apalachicola, Fla., to the lower anchorage. T minimum depth of water over this bar was 3½ feet.

The plan proposed and adopted was the deepening of the channel 11 feet, with a width of 100 feet.

The work was to be done under contract, by dredging, at an estimat cost of $100,000.

The following appropriations have been made:

By act approved June 14, 1880	$10,
By act approved March 3, 1881	10,
By act passed August 2, 1882	25,
By act approved July 5, 1884	10,
Total	55,

OPERATIONS PRIOR TO JUNE 30, 1885.

Work was done under four contracts, and resulted in a channel-w 1,500 feet long, 100 feet wide, with a minimum depth of 9 feet at me low water, and a continuation 4,178 feet long, 60 feet wide, and 9.5 f deep, costing $54,284.37.

The material removed was in many places apparently of recent d posit.

Complaints have been made several times that sawdust from the sa mills was finding its way into the channel, and the character of some the dredged materials would go to prove the truth of this.

As stated in previous reports, there was but little chance of th dredged channel maintaining itself unless entirely opened. The appropriations heretofore made have not permitted this to be done, and on each occasion part of the old work had to be done over. On this account the original estimate will have to be increased by $23,000.

To complete the project 177,000 cubic yards of material remain to be dredged, at an estimated cost of $68,000.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work was done after the completion of the contract in April, 1885, on account of an insufficient supply of money.

Recent reports from pilots crossing the bar show only 6½ feet of water in the dredged channel.

From the commencement of the fiscal year the work was under the charge of Capt. W. T. Rossell, Corps of Engineers, United States Army, until he was relieved by me, April 26, 1886, in accordance with paragraph 2, Special Orders No. 89, Headquarters of the Army, Adjutant-General's Office, Washington, April 16, 1886.

As stated in the Coast Survey charts of this bay, "the effects of the winds are often greater than the real tides, and the time and height of the apparent tides are greatly dependent on them." The prevailing gales are from the east, and, due to their influence, the natural channel, which at the mouth has a southeasterly direction, is bent sharply to S. ⅞ E. through an angle of 36 degrees, and then is nearly straight for a distance of about 8,000 feet, when it spreads and is lost on the flats, which have a general depth of about 4½ to 5 feet. The area of cross-section of the natural channel at the mouth of the river is 13,143 square feet; opposite the tow-head it is 13,200 square feet. Beyond this point it rapidly diminishes in depth. If from this point to the 9-foot curve the dredged channel could be protected on the east side by a dike, it would probably be permanent. If not, the permanency could be insured by connecting the ike with the shore by a jetty, with an additional jetty on the west side, f necessary. The dike alone would probably be sufficient, however. Its stimated cost, if of stone on a mattress foundation, would be $110,823, r if of re-enforced creosoted sheet-piling, $83,823.

The balance available and the appropriation asked for is to be used n extending, widening, and deepening the cut by dredging, under the roject.

Apalachicola Bay is in the collection district of Apalachicola, which is the nearest ort of entry. Nearest light-house, Cape Saint George Light. Nearest fort, defenses f Pensacola, Fla. Amount of revenue collected during fiscal year, $1,320.

Money statement.

uly 1, 1885, amount available	$715 63
uly 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	18 90
uly 1, 1886, amount available	696 73
mount appropriated by act approved August 5, 1886	12,000 00
mount available for fiscal year ending June 30, 1887	12,696 73
Amount (estimated) required for completion of existing project	56,696 73
Amount that can be profitably expended in fiscal year ending June 30, 1888	40,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, APALACHICOLA, FLA.,
Collector's Office, July 7, 188

Port of Apalachicola, Fla.

ARRIVED.

Class, &c.	Coastwise.		Foreign.	
	June 30, 1884, to June 30, 1885.	June 30, 1885, to June 30, 1886.	June 30, 1884, to June 30, 1885.	June 1885, June 188
Sailing vessels	28	27	63	
Total tonnage	8,896	7,911	34,936	28,

CLEARED.

Class, &c.	Coastwise.		Foreign.	
	June 30, 1884, to June 30, 1885.	June 30, 1885, to June 30, 1886.	June 30, 1884, to June 30, 1885.	June 1885, June 188
Sailing vessels	32	35	66	
Total tonnage	10,593	11,134	36,335	28,

Value of exports and imports and duties collected.	June 30, 1884, to June 30, 1885.	June 30, 1 to June 1886.
Value of exports	$266,000 00	$164,00
Value of imports	1,512 00	2,88
Duties collected	985 00	1,32

ADDITIONAL INFORMATION AND STATISTICS OF WHICH NO OFFICIAL RECORD IS K IN CUSTOM-HOUSE.

Number of steamers on river 6, of which one arrives at Apalachicola about every d

Number of small coaling vessels, from 20 to 300 tons, that enter this port for car of which no official record is kept (for 1886), 150.

Merchandise shipped coastwise for 1886, $1,500,000.

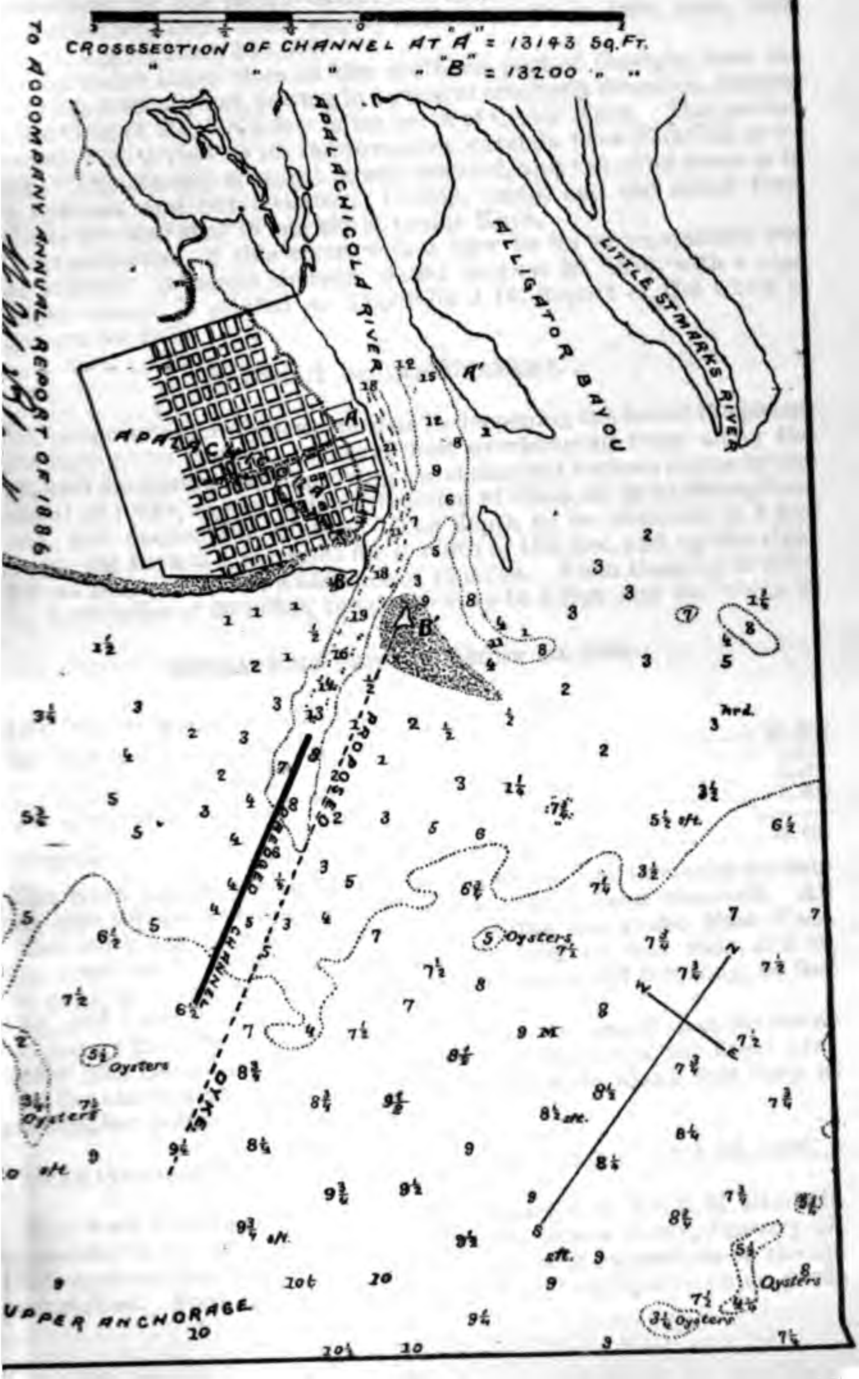
Merchandise received for Apalachicola and up the river, $1,000.000.

J. E. GRADY,
Collector of Customs.

I am indebted to Mr. Columbus Drew, of Jacksonville, Fla., for the following sta ment of the number of vessels entered and cleared coastwise at and from the dist and port of Apalachicola, Fla.:

Year.	Entrance.		Clearance.	
	Number of vessels.	Tonnage.	Number of vessels.	Tonnag
1875	29	1,139	23	
1876	18	424	18	
1877	22	351	17	
1878	12	1,150	16	1,
1879	12	1,803	26	2,
1880	37	9,568	41	1
1881	51	10,426	63	1
1882	50	12,647	62	1
1883	34	9,699	37	1
1884	29	9,579	34	1
Total	294	56,786	337	74,

HEAD OF APALACHICOLA BAY, FLA.
(TAKEN FROM COAST SURVEY CHART.)
SHOWING DREDGED CHANNEL AND PROPOSED DYKE.



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N 6.

IMPROVEMENT OF THE SUWANEE RIVER, FLORIDA.

rations for the improvement of this river have been carried on
November, 1881, under appropriations made in 1880, 1881, 1882,
384, aggregating $18,000.

Suwanee River rises in the southern part of Georgia, near the
iokee Swamp, and, flowing in a general southerly direction, empties
ie Gulf of Mexico, a few miles north of Cedar Keys. The portion
ved with a view to its improvement extends from Ellaville to its
i. The country adjacent is well wooded, and the chief trade is in
cypress, and cedar timber. Cotton, sirup, and the minor farm
cts are also sent to market at Cedar Keys.

examination of this river, with a view to its improvement, was
in 1879. A report thereon, dated August 26, 1879, with a plan
provement, is printed as Appendix J 16, Report of the Chief of
eers for 1879.

PROJECT OF IMPROVEMENT.

proposed improvement consists in deepening the bar at the passes
edging, the removal of snags and overhanging trees along the
and deepening and improving the channel at various places by the
al of rocks, snags, and construction of dams, so as to strengthen,
, and deepen the channel. The depth to be obtained is 5 feet
gh the bars at the passes for a width of 150 feet, and up the river
as Roland's Bluff, a distance of 74 miles. From there up to Ella-
a distance of 50 miles, the depth is to be 4 feet and the width 60

OPERATIONS PRIOR TO JUNE 30, 1885.

following appropriations have been made:

approved June 14, 1880	$5,000
approved March 3, 1881	3,000
passed August 2, 1882	5,000
approved July 5, 1884	5,000
otal	18,000

work has been done by contract. Twenty-nine thousand six hun-
and forty-nine cubic yards of material have been removed. All
work has been in the channel over the bar at the East Pass.
resulted in securing a cut 2,400 feet long, 65 feet wide, and 6½
eep at mean low water, with an extension 829 feet long, 60 feet
and 5 feet deep.

n examination of the channel later, it was found that favorable
had caused it to scour out, so that at the end of the fiscal year
he channel was 4,429 feet long, 60 feet wide, and 5 feet deep at
oalest point.

RATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

work was continued under the contract with Mr. S. M. Kimball,
ved by the Chief of Engineers, United States Army, January 17,
and was finished July 14, 1885, by the near exhaustion of the ap-
ation. Four thousand five hundred and eighty-two cubic yards

of material were removed, making a channel 1,406 feet long, 60 wide, and 5 feet deep at mean low water.

The distance from deep water in the Gulf through the East Pas the deep water in the river is 15,600 feet. As reported above, a c nel 5,835 feet long has been opened through this, with a mean water depth of 5 feet, and a width of 60 feet. There remains t dredged here a distance of 9,765 feet where there is an average d of 3½ feet.

No work has been done in the river above this point.

From the beginning of the fiscal year the work was under the ch of Capt. W. T. Rossell, Corps of Engineers, United States Army, u he was relieved by me, April 26, 1886, in accordance with parag 2, Special Orders No. 89, Headquarters of the Army, Adjutant-(eral's Office, Washington, April 16, 1886.

The balance on hand, and the appropriation asked for will be pended in carrying on the existing project.

Suwanee River is in the collection district of Cedar Keys, Fla., and Cedar Ke the nearest port of entry. Nearest light-house is Cedar Keys Light. Nearest fo Fort Marion, Florida.

No commercial statistics could be obtained.

Money statement.

July 1, 1885, amount available	$2, 3
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	2, 2
July 1, 1886, amount available	
Amount appropriated by act approved August 5, 1886	5, 0
Amount available for fiscal year ending June 30, 1887	5, 0
Amount (estimated) required for completion of existing project	32, 1
Amount that can be profitably expended in fiscal year ending June 30, 1888	32, 0
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

N 7.

IMPROVEMENT OF HARBOR AT KEY WEST, FLORIDA.

Operations for the improvement of this harbor have been carrie since July 16, 1883, under appropriation made by Congress in 18 $25,000, the only appropriation made.

Key West is the most northwesterly of the Pine Islands, know the Florida Keys, 60 miles southwest from Cape Sable, same dist from Tortugas, and 100 miles northeast from Havana. It is abo miles long, 2 broad, and from 12 to 15 feet above the sea level. It coral formation and sandy soil.

An examination of the harbor with a view to its improvement made in December, 1881. A report thereon, dated February 16, 1 with a plan of improvement is printed in Appendix K 25, of the Re of the Chief of Engineers, United States Army, for 1882.

PROJECT OF IMPROVEMENT.

roposed improvement consisted in forming, by dredging, a chan-
feet wide and 17 feet deep, at mean low water through the shoals
orthwest channel, a distance of about 5,000 feet.

OPERATIONS UP TO JUNE 30, 1885.

ork done was under contract. Dredging began July 28, 1883,
s continued until October 5, 1883, when the appropriation,
, was exhausted. The work accomplished was the removal of
ubic yards of material, thereby securing one cut entirely through
, having a depth of 15 feet at mean low water and a width of
at bottom, and 65 feet at top.

ATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

uly 1 the work was idle for lack of funds, and no appropriation
n made since.
the beginning of the fiscal year the work was under the charge
t. W. T. Rossell, Corps of Engineers, until he was relieved by
ril 26, 1886, in accordance with paragraph 2, Special Orders No.
dquarters of the Army, Adjutant-General's Office, Washington,
6, 1886.
s stated in the annual report for 1884 on this work that—

> ial reports as to the filling up of the dredged channel confirm the opinion ex-
> n my last annual report, namely, that the improvement would not be perma-

ollowing year personal inspections by Captain Rossell confirmed
this opinion. His recommendation that an appropriation of
be made for an examination before more work is attempted is re-
lly renewed, and the appropriation asked for will be applied to
rpose.
mprovement here would be of great benefit to all vessels plying
n Key West and Gulf ports, the use of this channel saving a dis-
f about 100 miles to them.

rbor at Key West is in the collection district of Key West, Fla., which is the
ort of entry. Nearest light-house, Key West Light. Nearest fort is Fort
lorida.

Money statement.

appropriated by act approved August 5, 1886	$2,500 00
t (estimated) required for completion of existing project	12,500 00
t that can be profitably expended in fiscal year ending June 30, 1888	3,500 00

tted in compliance with requirements of section 2 of river and
or acts of 1866 and 1867.

COMMERCIAL STATISTICS.

Port of Key West, Fla.

By the courtesy of Mr. Columbus Drew, of Jacksonville, Fla., I am able to gi
the following statistics for this port, which includes the harbors of Key West, Ch
lotte Harbor, and Tampa, for the calendar year 1885.

Class, &c.	Arrived.		Cleared.	
	Coastwise.	Foreign.	Coastwise.	Foreig
Steamers	85	2	87	
Sailing vessels	82	55	85	
Total tonnage	33, 801	8, 153	35, 282	2,

Value of exports and imports and duties collected.	Amoun
Value of exports	$207, 960
Value of imports	664, 237
Duties collected	492, 249

N 8.

IMPROVEMENT OF PEASE CREEK, FLORIDA.

Operations for the improvement of this stream have been carri
on since February 19, 1883, under appropriations made by Congress i
1881 and 1882, aggregating $11,000.

Pease Creek (Talakchopoko, Hatchee, or Peaseating Creek) rises i
the northeastern part of township 30 south, range 26 east, and flo
northwestward and westward to the middle of section 33, township 2
south, range 25 east, where it makes a junction with Saddle Creek, flo
ing southeastward from Lake Hancock. Thence its course is sout
west to Hickory Bluff, where it empties into Charlotte Harbor, makin
about 15 miles westing and 66 miles southing. It is fed by numero
lakes in the central part of Polk County. The principal tributaries i
the east are Little Charley, Tsala-apopka, Josh, and Prairie creeks, an
on the west Saddle, Whitten, and Chilocohatchie creeks. Besides the
streams, wide areas of swamp and hammock lands immediately borde
ing the river, and of the more elevated adjacent pine lands, are cover
during the rainy season, in July and August, with shallow pools of wate
which are discharged for the most part into Pease Creek. The strea
therefore exhibits much variation in its stages of water, the range b
tween extremes at Fort Meade being about 17 feet.

An examination of Pease Creek, with a view to its improvement, w
made late in 1879. A report thereon, dated March 10, 1880, with a pl
of improvement, is printed in Appendix K 17, Report of the Chief
Engineers for 1880.

PROJECT OF IMPROVEMENT.

The proposed improvement consists in rock excavation, removi
snags, and clearing the banks of overhanging trees so as to enable bo
drawing 2 feet of water to navigate during about half the year; minim
channel width to be 30 feet.

OPERATIONS UP TO JUNE 30, 1885.

: work has been done by a snag-boat built and equipped by the d States, and by hired labor.

:inning at the mouth of the stream the work has been carried on listance of 64 miles.

RATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

July 1, 1885, the work was idle for lack of funds, and no appro- n has been made since.

n the commencement of the fiscal year the work was under the of Capt. W. T. Rossell, Corps of Engineers, until he was relieved April 26, 1886, in accordance with paragraph 2, Special Orders, , Headquarters of the Army, Adjutant-General's Office, Wash- , April 16, 1886.

small balance available for this work has been used in the care lic property.

estimated that $5,700 can be profitably expended during the fis- ır ending June 30, 1888.

work is not yet sufficiently advanced to estimate whether there needed an additional sum to complete the present project.

not thought that the improvement will be permanent, and it is ted that about $2,500 per annum will be necessary to clear the of drifts and washouts after each season of high water, in order ntain the condition contemplated in the proposed project.

n the irregular and desultory character of the transportation, om the fact that no reliable record is kept of the commerce of the which is entirely coastwise, the larger portion being transported nd to Tampa and Manatee, no authentic statement of the same given.

proposed to expend the appropriation asked for in continuing the al of obstructions according to the project.

Creek is in the collection district of Key West, and Key West is the nearest entry. Nearest light-house is on Cinnabel Island, and the nearest fort is ylor.

Money statement.

1885, amount available		$546 82
1886, amount expended during fiscal year, exclusive of ities outstanding July 1, 1885	$32 75	
1886, outstanding liabilities	30 00	
		62 75
1886, amount available		484 07
appropriated by act approved August 5, 1886		5,000 00
available for fiscal year ending June 30, 1887		5,484 07

COMMERCIAL STATISTICS.

Southern Railway Company. Saint John's and Lake Eustis Railway Company. Florida Commercial Company.]

WARM SPRINGS, N. C., *July* 14, 1886.

SIR: Some weeks since your letter was received, requesting me to furnish h such information, statistical and otherwise, as I might be in possession of in relation to business, present and prospective, of Charlotte Harbor, on the southwe coast of Florida. My reply has been delayed, owing to reasons beyond my control.

The recent completion of the Florida Southern road to Punta Gorda, on Charlotte Ha bor, and the rapid influx of new settlers to that portion of the State, promises much com mercial importance in the very early future to this locality, hitherto inaccessible excep from the Gulf. Charlotte Harbor appears to be the most extreme southern harbo upon the mainland of Florida which is accessible to vessels of deep-water draught. Th country bordering Peace River (Pease Creek) for 75 miles north from Punta Gorda i very fertile, and capable of very high development. The soil is generally very ferti and the tropical latitude of this portion of the State promises an immunity from th cold which has hitherto limited the productions of that portion of Florida which ha been so rapidly settled during the past five years.

Since the completion of the Florida Southern road to Punta Gorda, steamboat com munication has been opened up between this point and New Orleans, also betwee this point and the various settlements around Charlotte Harbor and on the Withl coochee River. Before January 1, 1887, a steamship line running from Punta Gord to Key West and Havana will have been established. At many points along the coa of Charlotte Harbor and on the Withlacoochee River, which is a tributary of th harbor, extensive plantations of cocoanut are being inaugurated; in short, all frui of a purely tropical nature can be cultivated successfully in this latitude. The wate of Charlotte Harbor are swarming with fish, and large fisheries are now being estab lished at Punta Gorda. Since the commencement of the construction of the railroa from Bartow to Punta Gorda seven large mills for the manufacture of yellow-pi lumber have been erected, with a probable capacity of 30,000,000 feet per annum, a of which will be shipped to domestic and foreign markets from Charlotte Harbor.

The shipment of cattle from points on this harbor to Havana and other Gulf ma kets has lately been recommenced. The cattlemen estimate that 100 schooner loa per annum is a fair approximation of the shipments which will be made during th next five years.

I regret my inability to give more accurate figures, but as the business of this loc ity is done through the custom-house at Key West, it has been impossible to obta the accurate figures which you requested. The next twelve months will show a se tlement of this portion of the State and a development of business unprecedented Florida, and in another twelve months it will be possible to present in a more acc rate manner the information which you have requested.

Yours truly,

S. CONANT,
General Manager

Lieutenant BLACK,
First Lieutenant, U. S. Engineers.

N 9.

IMPROVEMENT OF THE HARBOR AT CEDAR KEYS, FLORIDA.

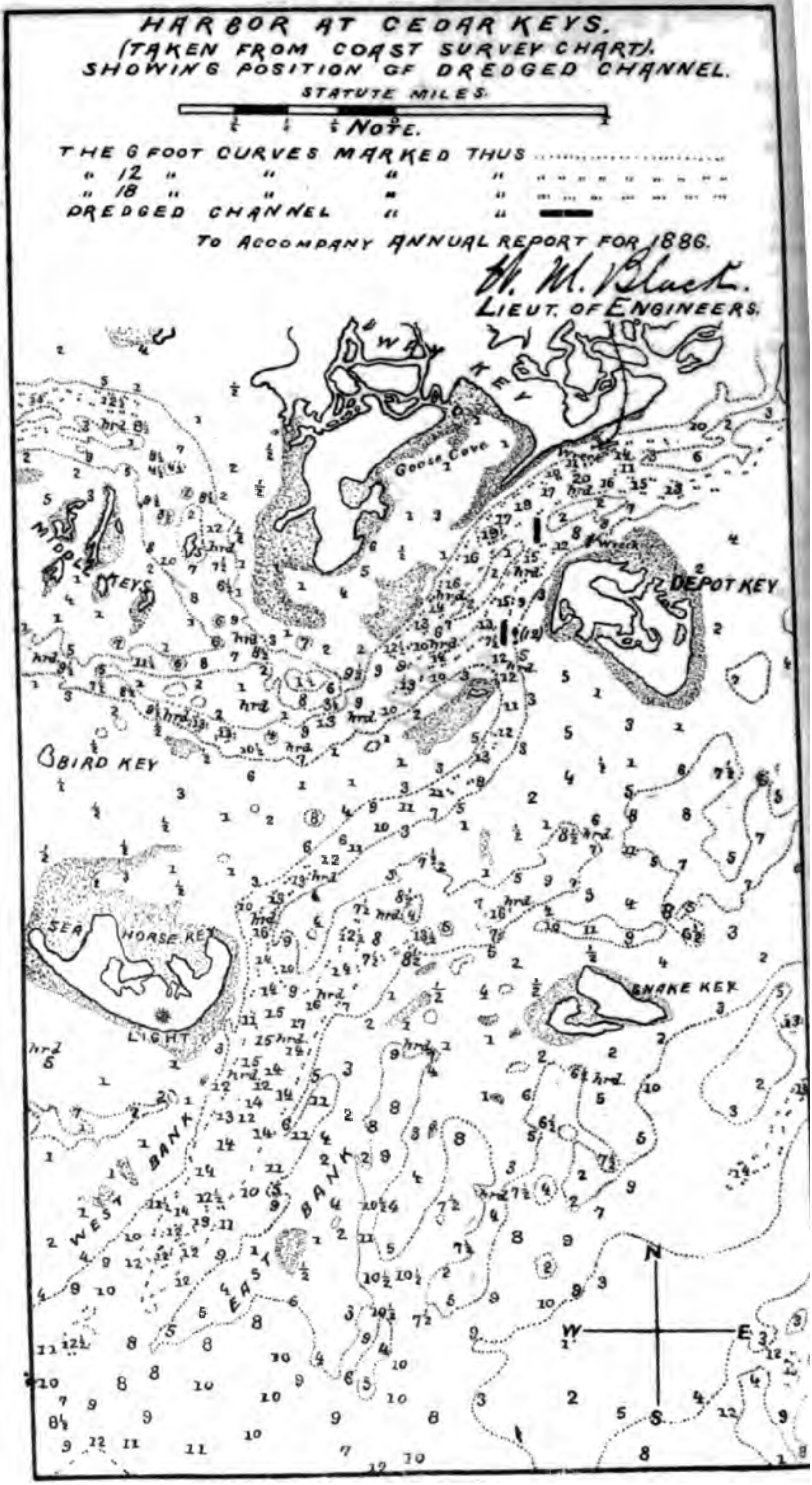
An improvement was made of this harbor in 1872–1881, as follows:

A cut 200 feet wide and 11½ feet deep, down to the limestone, through the mid ground; another, 200 feet wide and 12 feet deep, through the outer bar, excepting a point 80 feet from the line of black buoys, where the limestone is 11½ feet under t surface, the remaining 120 feet on the east side of the cut being fully 12 feet deep.

The harbor of Cedar Keys lies on the Gulf side of the peninsula Florida. It is the terminus of the Central Division Florida Railro and Navigation Company. For years this was the only line of railro between the Gulf and the Atlantic south of Pensacola, in Florida. Th principal business done is in lumber, and it forms a distributing poi to a large area to the north and south of it.

An examination with a view to its improvement was made in Nove ber, 1883. A report thereon, together with a plan of improvement, wa printed as Appendix N 30 to the Report of the Chief of Engineers fo 1884.

THE ASTOR LIBRARY
NY



HARBOR AT CEDAR KEYS.

(TAKEN FROM COAST SURVEY CHART).

SHOWING POSITION OF DREDGED CHANNEL.

STATUTE MILES.

NOTE.

THE 6 FOOT CURVES MARKED THUS ……………

" 12 " " " " - - - - - - -

" 18 " " " " -·· -·· -·· -··

DREDGED CHANNEL " " ▬▬

TO ACCOMPANY ANNUAL REPORT FOR 1886.

W. M. Black.

LIEUT. OF ENGINEERS.

H Ex1 pt2 v2 49 2

PROJECT OF IMPROVEMENT.

The approved project as there described is as follows: To obtain a annel 200 feet wide and with a least depth of 10½ feet from Cedar eys to the Gulf of Mexico. A depth of 9½ feet formerly existed in is channel. The depth is limited by the existence of beds of rock der the entire channel from 9½ to 12½ feet below mean low water, hich could only be removed at greater expense than the present and ospective commerce of the port would seem to warrant.

The estimated amount of material to be removed is 22,000 cubic yards, which at least 3,000 yards is rock. The estimated cost of the im-ovement is $25,000.

On this project an appropriation of $5,000 was made by act approved ly 5, 1884.

No work was done under this project prior to June 30, 1885.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

Under the contract with Mr. S. N. Kimball, approved by the Chief Engineers, United States Army, January 17, 1885, and mentioned in e last Annual Report, work was commenced on tho cut near Buoy No. , on October 14, 1885, and stopped by the exhaustion of the appro-iation December 28, 1885. Under this contract 370 cubic yards of nd and 615.3 cubic yards of stone were removed, making a channel 0 feet long (60 feet wide for 250 feet, 30 feet for 130 feet), and with average low-water depth of 11 feet. To complete the channel at this oint to 200 feet in width, and the desired depth, would require the re-oval of 7,800 yards more, of which one-fourth is rock.

Recent reports show that the dredged cut at this point continues clean. he shoaling continues slowly in the old cut through the middle ground, accordance with the anticipations of the officer in charge, as reported his annual report for 1884.

The appropriation asked for would be expended iu continuing work nder the present project.

From the beginning of the fiscal year the work was under the charge Capt. W. T. Rossell, Corps of Engineers, until he was relieved by me, pril 26, 1886, in accordance with paragraph 2, Special Order 89, Head-uarters of the Army, Adjutant-General's Office, Washington, April 16, 86.

Cedar Keys Harbor is in the collection district of Cedar Keys, and is a port of en-y. Nearest light-house, Cedar Keys Light. Nearest fort is Fort Marion.
No revenue was collected during the fiscal year.

Money statement.

uly 1, 1885, amount available	$4,802 55
uly 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	4,802 55
mount appropriated by act approved August 5, 1886	7,000 00
Amount (estimated) required for completion of existing project	13,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	13,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

Port of Cedar Keys, Fla.

ARRIVED.

Class, &c.	Coastwise.		Foreign.	
	June 30, 1884, to June 30, 1885.	June 30, 1885, to June 30, 1886.	June 30, 1884, to June 30, 1885.	Jun 188 Jun 188
Steamers	12	2	4	None.
Sailing vessels	6	3	1	None.
Total tonnage	7,928	1,069	3,083	None.

CLEARED.

Steamers	13	None.	None.	None.
Sailing vessels	6	6	2	
Total tonnage	7,422	1,498	427	

Value of exports and imports and duties collected.	June 30, 1884, to June 30, 1885.	Jun 188 Jun 188
Value of exports	1,112	2,
Value of imports	2,050	None.
Duties collected	2,090	None.

J. IRA GORE,
Special Deputy Collector of Customs.

I am indebted to Mr. Columbus Drew, of Jacksonville, Fla., for the following l ter:

NEW YORK, N. Y., *June* 22, 1886.

DEAR SIR: I am in receipt of your circular of the 1st. In reply, I would say th have a factory in Cedar Keys, Fla., for the manufacture of cedar boards for pen and sticks for penholders. The value of the property is about $25,000, and the prod 330,557 gross pencils and 23,589 gross penholders, the value of which is $48,375.29 the year 1885.

The Eagle Pencil Company and the Joseph Dixon Crucible Company have also fac ries in Florida.

Yours, truly,

EBERHARD FABER
Per O. G. BOGERT.

MR. C. DREW,
Jacksonville, Fla.

N 10.

IMPROVEMENT OF MANATEE RIVER, FLORIDA.

Operations for the improvement of this river have been carried o under only one appropriation of $12,000, by act passed August 2, 188

Manatee River rises in the southern part of Florida and flows in westerly direction, emptying into Tampa Bay on its southern shor On its banks exist several small settlements, among which may be me tioned Palma Sola, Manatee, Braiden Town, and Hendry. Along its banks settlers have established themselves, and the amount of fruit ətables raised is quite large. Along its headwaters and in the lying between it and the Caloosahatchie River and Pease Creek d fine cattle ranges.

ıipments of lumber, fruits, vegetables, and cattle are carried on river.

amination of Manatee River, with a view to its improvement, le in 1881. A report thereon, dated February 16, 1882, with mprovement, is printed as part of Appendix K 25, Annual Rehe Chief of Engineers for 1882.

PROJECT OF IMPROVEMENT.

:oposed improvement consisted in forming a channel, by dredgfeet wide and 13 feet deep at mean low water, from Tampa Bay 's and McNeill's points, a distance of about 4 miles. The availth before improvement was 8 feet.

OPERATIONS UP TO JUNE 30, 1885.

ing was begun on this improvement March 26, 1883, and conntil April 14, 1883. It was again resumed February 18, 1884, tinued until April 25, 1884, when all work ceased, and no furk has been done, owing to lack of funds.

ɡ this time one cut was made 2,150 feet in length, 1,750 feet of ıs a width of 60 feet and a depth of 12½ feet, and 400 feet has a 35 feet and a depth of 12½ feet; 21,269 cubic yards of material ıoved.

TIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

ly 1, 1884, there were no funds available for this work, and no ation has been made since. In consequence no work has been

the commencement of the fiscal year the work was under the ɔf Capt. W. T. Rossell, Corps of Engineers, until he was re- me, April 26, 1886, in accordance with paragraph 2, Special Io. 89, Headquarters of the Army, Adjutant-General's Office, ɡton, April 30, 1886.

roposed to use the appropriation asked for in extending, widendeepening the channel by dredging, according to the project.

River is in the collection district of Key West, which is the nearest port Nearest light-house, Egmont Key Light. Nearest fort is Fort Jefferson,

Money statement.

ppropriated by act approved August 5, 1886	$8,000 00
(estimated) required for completion of existing project	50,000 00
that can be profitably expended in fiscal year ending June 30, 1888	50,000 00

ed in compliance with requirements of section 2 of river and harts of 1866 and 1867.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, KEY WEST, FLA.,
Collector's Office, July 20, 1886.

R: Acknowledging receipt of your letter under date of the 19th ultimo, to collector at Manatee, which has been referred by that officer to this office, requesting certain commercial statistics of said port, I beg to submit herewith information as can be obtained from the records.

It will be observed that the number of vessels, steam and sail, which arrived departed coastwise only are given. Their tonnage and crews could not be ascertai As the law prohibits the entry or clearance of vessels to and from foreign ports other than ports of entry, there have been no foreign arrivals or departures, imp or exports, or duties collected at the port of Manatee.

Very respectfully,

J. V. HARRIS,
Collector.

Lieut. W. M. BLACK,
Corps of Engineers.

Port of Manatee, Fla.

Coastwise.	Arrived.		Cleared.	
	June 30, 1884, to June 30, 1885.	June 30, 1885, to June 30, 1886.	June 30, 1884, to June 30, 1885.	June 1885, t June 188
Steamers	208	216	207	
Sailing vessels	75	89	76	

N 11.

IMPROVEMENT OF CALOOSAHATCHIE RIVER, FLORIDA.

Operations for the improvement of this river have been carried since October 16, 1883, under appropriations made by Congress in 188 and 1884, aggregating $10,000.

The portion of the Caloosahatchie which is proposed for improve ment extends from its mouth to Fort Meyers, a distance of 14 miles.

The Caloosahatchie River rises in the Everglades of Florida, flows in westerly direction, and empties into San Carlos Bay but a short distanc above Punta Rassa. Through a great portion of its length the land low, swampy, and unfit for use without expensive drainage. Whereve the land is high, it is rich and capable of producing fruits and vegeta bles. Along its banks are large cattle ranges. Punta Rassa is th shipping point for this country. This river has been connected by canal with Lake Ockeechobee, by the Ockeechobee Drainage Company, an by this canal a through inland steamboat route has been formed fro Kissimee City to the Gulf.

An examination of this river, with a view to its improvement, wa made in March and April, 1879. A report thereon, dated August 2 1879, with a plan of improvement, is printed in Appendix J 17, Repor of the Chief of Engineers for 1879.

PROJECT OF IMPROVEMENT.

The proposed improvement consists in deepening the channel by dredging from the mouth of the river to Fort Meyers, so as to give a depth of 7 feet at mean low water, and a width of 100 feet.

OPERATIONS UP TO JUNE 30, 1885.

Prior to this date, 6,905 cubic yards of material had been removed, clearing two miles of channel.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

The work was done under contract with S. N. Kimball, approved by e Chief of Engineers, January 17, 1885, as stated in the last annual port. Dredging was begun and finished in August. Five thousand bic yards were removed near Jew Fish Bayou, and a clear channel 100 et wide and 7 feet deep was obtained from the mouth to Fort Meyers, us completing the present project.

Under this project no further appropriations are needed. Should a rther improvement of the river be determined on, I would recommend at in the absence of any reliable maps a survey be first made, extending from the Punta Rassa Bar to the head of navigation. The estimated st of the survey is $2,000.

The balance on hand will be expended in caring for the work already ne.

From the beginning of the fiscal year the work was under the charge ' Capt. W. T. Rossell, Corps of Engineers, until he was relieved by e April 26, 1866, in accordance with paragraph 2, Special Orders No.), Headquarters of the Army, Adjutant-General's Office, Washington, pril 16, 1886.

The following appropriations have been made:

' act of Congress passed August 2, 1882	$5,000
' act of Congress approved July 5, 1884	5,000
Total	10,000

Caloosahatchie River is in the collection district of Key West, which is the nearest rt of entry. Nearest light-house is Key West Light, and the nearest fort is Fort ylor.

Money statement.

ly 1, 1885, amount available	$4,455 29
ly 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	3,911 88
ly 1, 1886, amount available	543 41
nount appropriated by act approved August 5, 1886	4,000 00
nount available for fiscal year ending June 30, 1887	4,543 41

COMMERCIAL STATISTICS.

I am indebted to Mr. Francis M. Durrance, deputy collector and inspector of cusms at Charlotte Harbor, Fla., for the following statistics:

At present a coasting steamer arrives three times per week and one from New Orans, La., semi-monthly. Sailing vessels in coasting trade arrive almost daily. One ttle steamer of 197 tons arrives semi-monthly from Havana.

Not being a port of entry, no vessels clear from this port.

The value of exports (cattle) is about $4,000 per month.

N 12.

IMPROVEMENT OF APALACHICOLA RIVER, FLORIDA.

Operations for the improvement of this river have been carried on ice December, 1874, under appropriations made by Congress in 1874, 75, 1876, 1879, 1880, 1881, 1882, and 1884, aggregating $39,500.

The following description of the river is taken from a report made by

Assistant Engineer M. J. Mack to Captain (now Major) A. N. Dam Corps of Engineers, on June 7, 1883.

The Apalachicola River is formed by the junction of the Chatta chee and Flint rivers, at the southwestern corner of the State of Geor and runs in a southerly direction through the State of Florida, em ing into Saint George's Sound at the city of Apalachicola, pas through a very low swampy country, which is annually overflowed the freshets from the Chattahoochee and Flint rivers, rendering land comparatively useless for agricultural purposes for a great dist on either side. There is, however, a quantity of fine timber, m cypress and pine, along its banks, and as it has a number of tribut extending far into the country, among them Chipola River, Ca Owl, Fort Gadson, Smith, and Brinsley creeks, a fine means is gi of rafting it to Apalachicola, where two (now four) mills of large ca ity are kept in constant operation.

The importance of this river has increased since then by a ste growth of the settlement along its banks, especially of the town Apalachicola at its mouth.

Cotton is grown along the banks and turpentine and resin shipp

PROJECT OF IMPROVEMENT.

The project consists in securing a channel 100 feet wide and 6 deep at low water, by removing snags and overhanging trees, as well widening and straightening Moccasin Slough.

OPERATIONS UP TO JUNE 30, 1885.

This improvement was commenced in December, 1874, the steamb Clara Dunning being employed in removing logs and overhanging tr

The depth of water was sufficient, as well as the general width f bank to bank, but its availability for purposes of commerce was in consequence of numerous snags.

The river at Virginia Bend, 50 miles above Apalachicola, was c pletely closed for a distance of 6 miles, and the only chance for nav tion was through Moccasin Slough, which was very crooked, nar and badly obstructed with overhanging timber, so much so that it quired several days for a boat, with the use of lines, to pull throug

The original project for improvement contemplated a channel feet wide and 6 feet deep at low water, to be secured by removing s and overhanging trees, as well as widening and straightening Moc Slough, and no change has been made in the original design.

In addition to the original project, Chipola Cut-off has been op to White's Bluff, on Chipola River, a distance of 9 miles.

The improvement may be considered as completed as projected, river being in good navigable condition, and only requiring the rem of the annual accumulation of snags and overhanging trees, and work as can be done with the amount of $2,000, which has been mated as necessary annually for preserving the improvement.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 188

From the commencement of the fiscal year the work was under charge of Capt. W. T. Rossell, Corps of Engineers, until he was reli by me April 26, 1886, in accordance with paragraph 2, Special O No. 89, Headquarters of the Army, Adjutant-General's Office, W ington, April 16, 1886.

was done during August and September by hired labor, using ed States snag-boat belonging to the Pease Creek improvement 'ed steamboat for towing.

at arrived August 10, and work was begun at a point about above Moccasin Slough, and had progressed up the river about hen a rise in the river made further effective work impossible me. The appropriation being nearly exhausted it was deter- stop for the season. The snag-boat was towed back to the ochee River, and there laid up September 29. During the s 110 snags and logs, varying in length from 40 to 80 feet, were

lowing appropriations have been made:

Congress approved June 23, 1874	$10,000
Congress approved March 3, 1875	10,000
Congress approved June 18, 1878	8,000
Congress approved March 3, 1879	5,000
Congress approved June 14, 1880	2,000
Congress approved March 3, 1881	1,500
Congress passed August 2, 1882	2,000
Congress approved July 5, 1884	1,000
l	39,500

lance available and the appropriation asked are to be used in g the improvement by the removal of obstructions according t.

cola River is in the collection district of Apalachicola, which is the near- entry, Nearest light-house, Cape Saint George Light. Nearest fort, de- 'ensacola, Fla. Amount of revenue collected during fiscal year, $1,320.

COMMERCIAL STATISTICS.

mercial statistics, see Annual Report, on improvement of Apa- Bay, Florida.

Money statement.

5, amount available		$2,255 49
6, amount expended during fiscal year, exclusive of s outstanding July 1, 1885	$2,072 81	
5, outstanding liabilities	65 90	
		2,138 71
6, amount available		116 78
propriated by act approved August 5, 1886		1,000 00
ailable for fiscal year ending June 30, 1887		1,116 78
(estimated) required for preservation of improvement, annually		2,000 00
hat can be profitably expended in fiscal year ending June 30, 1888		2,000 00

d in compliance with requirements of section 2 of river and acts of 1866 and 1867.

N 13.

MPROVEMENT OF WITHLACOOCHEE RIVER, FLORIDA.

ions for the improvement of this river have been carried on in e with the project submitted to the Chief of Engineers by the n in charge, in 1879, and published as part of Appendix K 8 to al Report of the Chief of Engineers for 1880.

The project adopted is to improve the river by the removal of snags, overhanging trees, and loose rocks, and by deepening of some of the worst shoals and a bar at the mouth of the river, so as to enable boats drawing 2 feet to navigate the river during about half the year from the mouth to Hay's Ferry, a distance of 100 miles.

The original depth of the river was from 1 to 7½ feet, with a width of from 75 to 150 feet.

OPERATIONS PRIOR TO JUNE 30, 1885.

Under the appropriations a suitable snag-boat had been built and equipped and the river had been gone over, removing some of the worst shoals. A navigable channel now exists from the mouth to Morrison's landing, a distance of 30 miles.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1886.

No work has been done during the year, owing to the small balance of the appropriation remaining on hand.

From the commencement of the fiscal year the work was under the charge of Capt. W. T. Rossell, Corps of Engineers, until he was relieved by me, April 26, 1886, in accordance with paragraph 2, Special Orders No. 89, Headquarters of the Army, Adjutant-General's Office, Washington, April 16, 1886.

It is proposed to extend the improvement up to Fort Dade.

The upper river has been reached by two railroads, the Florida Southern and the Florida Transit and Peninsula, thus increasing its importance. The principal industry is the raising and shipping of fruits and vegetables. The arrival of the railroads has given a great impetus to this business, and they seek the river as means of transportation to the roads.

The money now available is to be used for the care and preservation of the public property.

The appropriation asked for is to be applied to extending the improvement under the existing project.

The following appropriations have been made:

By act of Congress approved March 3, 1881	$7,5
By act of Congress approved July 5, 1884	3,
Total	10,5

Withlacoochee River is in the collection district of Cedar Keys, Fla., which is the nearest port of entry. Nearest light-house, Cedar Keys Light. Nearest fort is Fort Marion, Florida.

Money statement.

July 1, 1885, amount available	$428
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	272
July 1, 1886, amount available	156
Amount appropriated by act approved August 5, 1886	3,000
Amount available for fiscal year ending June 30, 1887	3,156
Amount (estimated) required for completion of existing project	10,400
Amount that can be profitably expended in fiscal year ending June 30, 1888	10,400
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

N 14.

L OF SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

al of the wreck of the steamer Dictator.—This was a wooden el steamer, of 512 tons, built at Brooklyn, N. Y., 1863. It was o the water's edge in the harbor of Tampa December 26, 1883, hull and machinery lay near Spanish Town Point, in the edge ain ship-channel.

ng been reported as an obstruction to navigation, the Honorable y of War directed that the proper steps should be taken for ral. Due notice to the owners, in accordance with law, was l in February, 1885.

OPERATIONS DURING THE PAST FISCAL YEAR.

vember 12, 1885, proposals for the removal of the wreck were Messrs. William H. Brown and George Theodore, of New La., were the lowest bidders, and the contract was awarded for $2,500.

reement states, "Work of removal is to be commenced on or ecember 11, 1885, and is to be completed on or before Febru- 386." After numerous delays operations under the contract nuary 13, 1886. Work progressed very slowly, and there were s disagreements between the contractors. On February 25 the ors finally disagreed, and one of them abandoned the work.

ril 8, 1886, authority was given by the Chief of Engineers, tates Army, to annul the contract, the time for its completion xpired.

ork was readvertised, and proposals opened June 17. Messrs. H. Schenck and Nicholas Theodore, the lowest bidders, were the contract for $2,500, and the necessary papers are now being

ril 26 Captain Rossell transferred the charge of this work to irtue of paragraph 2, Special Orders, No. 89, Headquarters of y, Adjutant-General's Office, Washington, April 16, 1886.

al of sunken scow from harbor at Tampa, Florida.—On August in Rossell reported that a scow, sunk during the war across channel near Spanish Town Point, was an obstruction to nav- In letter of September 9, the necessary steps for its removal ected. On September 25, the required public notice was given. vertisement, on December 20, proposals for the removal of the e opened. Messrs. W. H. Brown and George Theodore, the dders, were awarded the contract for $750. Subsequently, be- contract was made, Mr. Theodore withdrew, and the contract red into with Mr. Brown alone.

ions under it commenced May 3, and were concluded May 17, scow having ben removed.

ril 26, Captain Rossell transferred the charge of this work to irtue of paragraph 2, Special Orders, No. 89, Headquarters of y, Adjutant-General's Office, Washington, April 16, 1886.

Abstract of proposals for removing wreck of the steamer Dictator, now lying in harbor at Tampa, received and opened by Capt. William T. Rossell, Corps of Engineers, November 1 1885.

No.	Names of bidders.	Amount.	Remarks.
1	E. A. McDonald	$15,000	
2	J. Francis Le Baron	3,700	
3	W. E. Chapman	9,980	
4	W. H. Brown and George Theodore	2,500	Lowest bid. Guarantee signed by bidders.
5	John H. Gardner	3,874	Instructions to bidders not attached to propos
6	R. G. Ross	4,300	

Contract awarded to William H. Brown and George Theodore, November 30, 18 Contract annulled April 8, 1886.

Abstract of proposals for removing sunken scow from harbor at Tampa, Fla., received an opened by Capt. William T. Rossell, Corps of Engineers, December 20, 1885.

No.	Names of bidders.	Amount.	Remark
1	William H. Brown and George Theodore	$750	Lowest bi
2	Rittenhouse Moore	2,250	

Contract awarded to W. H. Brown. Operations commenced May 3, 1886. Contr completed May 17, 1886.

Abstract of proposals for removing wreck of steamer Dictator now lying in harbor at Tam Fla., received and opened by Lieut. W. M. Black, Corps of Engineers, June 17, 1886.

No.	Names of bidders.	Amount.	Remark
1	T. N. Anderson and H. Jackson	$5,945	
2	L. S. Dawes and W. H. Brown	4,000	
3	American Dredging Company	6,800	
4	C. H. Schenck and N. Theodore	2,500	Lowest bi
5	William E. Chapman	7,480	
6	Roderick G. Ross	3,300	
7	S. N. Kimball	5,900	
8	Cresent City Wrecking Company	6,500	

Contract awarded to C. H. Schenck and N. Theodore. Operations to comme August 2, 1886, to be completed September 2, 1886.

APPENDIX O.

IMPROVEMENT OF CERTAIN RIVERS IN THE STATES OF GEORGIA, FLORIDA, AND ALABAMA—IMPROVEMENT OF THE HARBOR AT PENSACOLA, FLORIDA.

REPORT OF CAPTAIN R. L. HOXIE, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. **Ocmulgee River, Georgia.**
2. **Oconee River, Georgia.**
3. **Flint River, Georgia.**
4. **Oostenaula and Coosawattee rivers, Georgia.**
5. **Coosa River, Georgia and Alabama.**
6. **Chattahoochee River, Georgia and Alabama.**
7. **Alabama River, Alabama.**
8. **Tallapoosa River, Alabama.**
9. **Cahaba River, Alabama.**
10. **Conecuh—Escambia river, Florida and Alabama.**
11. **Choctawhatchee River, Florida and Alabama.**
12. **Bayou La Grange, Florida.**
13. **Harbor at Pensacola, Florida.**

UNITED STATES ENGINEER OFFICE,
Montgomery, Ala., August 10, 1886.

GENERAL: I have the honor to transmit herewith annual reports upon the river and harbor improvements under my charge for the fiscal year ending June 30, 1886.

Very respectfully, your obedient servant,

R. L. HOXIE,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

O 1.

IMPROVEMENT OF OCMULGEE RIVER, GEORGIA.

The Ocmulgee River rises in the northwestern part of Georgia, flows past the towns of Macon, Ga., and Hawkinsville, Ga., and unites with the Oconee River about 10 miles below Lumber City, to form the Altamaha. The State of Georgia has expended about $60,000 for the improvement of this river. The first examination and survey by authority of the United States was made in 1852, and another in 1875. Subsequent to this a plan of improvement was adopted which contemplates the removal of obstructions from the channel, and cutting through rock shoals so as to obtain a navigable channel 60 feet in width and 4 feet depth at low water from Macon, Ga., to the Oconee River.

The expenditure of $57,000 up to the present time under the adop plan of improvement has resulted in securing navigation of the river a stage from 2 to 3 feet lower than was practicable before the co mencement of the improvement.

The work done during the past fiscal year was as follows:

Number of overhanging trees felled and cut up	5
Number of logs on bank cut up	
Number of stumps on bank cut level	5
Number of logs and snags removed from river	6

At the close of last season's work it was found that the snagboat i use on this improvement was completely worn out, not worth repairi and not worth the cost of keeping over for another season. At the sa time the appropriation was exhausted; it was therefore concluded t condemn the boat, and it was sold at public auction in November, 188 leaving the improvement without any working plant.

Before work can be resumed, it will be necessary to provide a wor ing plant, and it is recommended that this be a steam snagboat of sm size, costing, with her equipment, about $10,000, to be used in comm for the Ocmulgee and Oconee rivers.

The appropriation asked for can be profitably expended in the co struction of this snagboat, paying one-half the cost, and in continui the work of removing obstructions from the river channel.

During the past season the work has been in charge of Assistant E gineer C. A. Locke to September 11, 1885, and of F. C. Armstrong t October 31, 1885.

There is no working plant upon this improvement, but one-half th value of the working plant to be provided for this river, in comm with the Oconee River, is estimated at $5,000. When worked to i full capacity for one-half the working season, an annual expenditure $15,000 is required; a less expenditure with such working plant is i judicious. With an increase of working plant about $25,000 can b profitably expended during the fiscal year ending June 30, 1888.

The original estimate of cost of this improvement is $112,480. T this must be added the cost of removing obstructions brought into th channel since the date of this estimate by the annual freshets. Th river has a movable bottom and caving banks which are covered wi timber. The improvement will have that degree of permanence whi attaches to works of contraction under such circumstances. An annu expenditure will be required for the maintenance of the work and th removal of fresh obstructions.

The census of 1880 gives, for the counties bordering upon this riv within the limits of the proposed improvements, a total assessed val ation of real and personal property amounting to $17,876,408, and total taxation of $272,180.

Money statement.

July 1, 1885, amount available	$2,376
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	2,376
Amount appropriated by act approved August 5, 1886	7,500
Amount available for fiscal year ending June 30, 1887	7,500

Amount (estimated) required for completion of existing project	48,000
Amount that can be profitably expended in fiscal year ending June 30, 1888	25,000

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

ffort has been made to obtain commercial statistics from parties presumably in vigation of this river, but none have been received. In 1885 the following steamboats were employed in the navigation of the river: Colville, Mary Jeter, Wadley, Mary Cooper, North State, and Cumberland. boats then carried about 6,800 barrels of turpentine, 28,000 barrels rosin, and),200 tons of cotton, provisions, &c. In addition to this about 30,000,000 feet ber (B. M.) was rafted down the river.

O 2.

IMPROVEMENT OF OCONEE RIVER, GEORGIA.

s river rises in Northeast Georgia, flows past the towns of Mil- ville and Dublin, Ga., and joins the Ocmulgee in the southern part e State, forming the Altamaha. The State of Georgia has ex- :d about $35,000 for its improvement. The first examination of iver, by authority of the United States, was made in 1874, and a of improvement adopted, contemplating the removal of obstructions the channel, and blasting through rock reefs where necessary, in to secure a depth of about 3 feet at low water from Milledgeville e Ocmulgee River. The work done up to the present time, under lan of improvement, at an expenditure of $23,499.22, has resulted abling steamboats to navigate the river at a stage of water 4 feet than that at which navigation was practicable before the improve- was commenced.

work was done during the past fiscal year owing to the exhaustion e appropriation for this improvement.

the close of last season's work it was found that the snag-boat in n this improvement was completely worn out; not worth repairing, not worth the cost of keeping over for another season. It was fore concluded to condemn the boat, and it was sold at public on in November, 1885, leaving the improvement without any work- lant.

fore work can be resumed it will be necessary to provide a working ; and it is recommended that this be a steam snag-boat of small costing, with her equipment, about $10,000, to be used in common e Oconee and Ocmulgee rivers.

e appropriation asked for can be profitably expended in the con- tion of this snag-boat, paying one-half the cost, and in continuing ork of removing obstructions from the river channel.

ere is no working plant upon this improvement, but one-half the of the working plant to be provided for this river, in common the Ocmulgee River, is estimated at $5,000. When worked to its apacity for one-half the working season, an annual expenditure of 00 is required; a less expenditure, with such working plant, is in- ions. With an increase of working plant, about $25,000 can be tably expended during the fiscal year ending June 30, 1888.

e original estimate of cost of this improvement is $50,000. To this be added the cost of removing obstructions brought into the river nel by freshets since the date of the estimate. The river has gen- y a movable bottom and caving banks covered with timber. The ovement will have that degree of permanence which attaches to s of contraction in such a stream. An annual expenditure will be red for the removal of fresh obstructions and the maintenance of ork.

The census of 1880 gives, for the counties bordering upon this river within the limits of the proposed improvement, a total assessed valuation of real and personal property amounting to $7,475,214, and a total taxation of $99,973.

Money statement.

July 1, 1885, amount available	$352 22
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	*351 44
July 1, 1886, amount available	78
Amount appropriated by act approved August 5, 1886	9,000 00
Amount available for fiscal year ending June 30, 1887	9,000 78
Amount (estimated) required for completion of existing project	17,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	17,500 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

An effort has been made to obtain commercial statistics from parties presumably interested in the navigation of this river, but without success.

In 1885 the following-named steamboats were employed upon this river:

	Tons.
Laurens	[illegible]
Wadley	100
Ida	[illegible]
Mary Cooper	150
North State	[illegible]

These boats carried during that year about 4,400 barrels of turpentine and about 6,000 tons cotton, merchandise, provisions, &c., besides which about 20,000,000 feet of lumber were rafted down the river.

O 3.

IMPROVEMENT OF FLINT RIVER, GEORGIA.

This river rises in the western part of Georgia near the city of Atlanta. It flows past Montezuma, Albany, Newton, and other towns to Chattahoochee, Fla., where it unites with the Chattahoochee to form the Apalachicola River. The plan of improvement made pursuant to an examination and survey of the river in 1872 and 1873, modified after further examination in 1880, contemplates a low-water navigable channel 3 feet in depth and 100 feet in width, from the mouth of the river to Albany, Ga., a distance of 105 miles, and a navigable channel for light-draught steamers at a moderate stage of water from Albany to Montezuma, an estimated distance of 100 miles. The work to be done consists in the removal of snags and other obstructions from the channel and overhanging trees from the banks, the scouring of bars by works of contraction, and cutting of the prescribed channel through the rock-reefs.

The expenditure up to the present time of $94,919.87, has resulted in securing a fair navigable channel at low water from Chattahoochee Tea Cup Shoals, about 19 miles below Albany, at which point ope tions were suspended at the close of last working season, and an i proved high-water channel between Montezuma and Warwick, 40 mi above Albany.

ng the past fiscal year a small hand-power snag-boat was k on the river between Montezuma and Warwick removing tting overhanging trees, effecting the removal of 814 snags nging trees; and a number of drilling-scows on the reefs abou s below Albany were engaged in effecting the removal of 5,477 ards of rock, and 440 snags and overhanging trees.

following table shows the condition of the improvement on June 6:

Table showing condition of improvement on June 30, 1886.

s of places.	Number of places improved.	Below Albany.	Original depth.	Present depth.	Original width.	Present width.	Number of cubic yards of rock removed from each place.	Remarks.
		Miles.	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Cu. yds.*	New channel blasted.
s Island	1	88	1	3	0	100	67	Dry bowlder removed.
k	2	85	0	2	60	100	152	Bowlder in mid-channel removed.
Rock	3	84½	½	4	50	100	43	Bowlder on point removed.
Rock	4	79½	½	4	70	100	54	Bowlder in mid-channel removed.
Rock	5	77	½	4	50	100	415	Several reefs removed.
Bainbridge	6	75	1	4	100	100		Do.
ck Reach	7	72	½	4	40	100	122	Loose rocks and bowlders removed.
oss Chute	8	71	½	4	30	100	1,171	Do.
ate	9	64	0	4	75	100	120	Dry ledge removed to widen channel.
tack	10	63	0	3	80	100	483	Do.
1 to No. 12	11 to 22	63 to 54	1 1	3 3	40	100	1,372	Loose rock, large bowlders, and solid reefs removed.
's Point	23	54	0	3	70	100	1,231	Dry ledge and bowlders removed.
Shoals	24	53	1	3	40	100	897	Loose rock and solid ledges removed.
Shoals	25	51½	0	3	0	100	3,636	New channel blasted through solid rock.
Shoals	26	51	1	3	40	100	315	Loose rocks, solid ledges blasted and removed.
hute	27	50½	0	3	20	100	2,151	New channel blasted, cut-off made, and island removed.
Lower Shoal	28	48¾	1	3	20	100	86	Large bowlders and loose rocks removed.
Middle Shoal	29	48½	0	3	20	100	214	Do.
Upper Shoal	30	48¼	0	3	....	75	145	Do.
n's Shoal	31	48	0	3	....	90	258	Do.
land	32	44	2	3	....	75	92	Solid ledge and loose rocks removed.
Shoals	33	43½	2	3	....	100	285	Do.
ugh	34	41½	1½	3	....	100	562	Do.
Shoals	35	41	1	4	50	50	554	Do.
Reef No. 3	36	40¼	½	5	25	75	440	Do.
Reef No. 2	37	39¾	2	3	20	80	631	Do.
Reef No. 1	38	39½	2	5	20	80	134	Do.
a's Shoals	39	39¼	2	3	40	80	83	Large bowlders and loose rocks removed.
als	40	37¾	2	4	30	100	105	Do.
lands	41	36¼	1½	4	40	100	312	Solid ledge and loose rocks removed.
Shoals	42	35½	1	3	30	100	103	Do.
	43	33¼	1	3	30	100	141	Large bowlders and part of island removed.
Newton and n's.	44	31¼	2	3	50	100	40	One large bowlder removed.
's Shoals	45	22½	1½	3	20	80	3,598	Five distinct reefs, 1 mile in length, of loose rock and solid ledges removed.
Island	46	21	1½	3	30	100	838	Point of rock island cut off and bowlders removed.
Shoals	47	19½	2	3	...	...	1,555	Three separate reefs, loose rock, and bowlders removed; not completed.

The funds remaining on hand and the appropriation asked for can be profitably expended in continuing the work of cutting through rock shoals below Albany, and in removing obstructions from the river channel between Albany and Montezuma. The work has been in charge of Assistant Engineer P. M. Slaughter.

The value of the working plant upon this improvement is estimated at $1,727. When worked to its full capacity an annual expenditure of $20,000 is required; a less expenditure, with the present working plant, is injudicious. With an increase of working plant about $40,000 can be profitably expended during the fiscal year ending June 30, 1888.

The original estimate of cost of this improvement is, from Chattahoochee, Fla., to Albany, Ga., $184,862; from Albany to Montezuma, Ga., $15,000. To the latter estimate should be added the cost of removing the annual accumulation of obstructions due to freshets in the upper river; this requires a constant annual expenditure. For the lower river the work is principally upon the rock bottom of the river, and is of a permanent character.

The census of 1880 gives for the counties bordering upon this river within the limits of the proposed improvement a total assessed valuation of real and personal property amounting to $13,451,611, and a total taxation of $156,016.

Money statement.

July 1, 1885, amount available		$14,449 27
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$12,339 38	
July 1, 1886, outstanding liabilities	163 00	
		12,502 38
July 1, 1886, amount available		1,946 89
Amount appropriated by act approved August 5, 1886		20,000 00
Amount available for fiscal year ending June 30, 1887		21,946 89

Amount (estimated) required for completion of existing project	83,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	40,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

Number of boats employed in the commerce of this river	10
Valuation	$126,00
Tonnage	1,40
Draught in feet	2 to 5

During the year ending June 30, 1886, these boats carried in freight as follows:

Commercial fertilizers	tons	6,54
Iron	do	20
Cotton	bales	22,76
Grain	bushels	27,68
Lumber	feet	4,730,00
Merchandise	bales	76
Merchandise	barrels	189.70
Live stock	number head	
Turpentine	barrels	3,
Resin	do	15,
Square and round timber (by raft)	feet	3,000,

Total valuation	$3,185,274
Total valuation of freights	40,700
Total valuation of passenger traffic	27,000
Aggregate valuation of river business	3,252,974
Aggregate value in 1885	3,234,163

The large increase in our river business for the present year is mainly caused by the improved condition of the river as caused by Government appropriations, thus enabling our boats to run the year through, and, by connections with railroad points below, to offer through rates for cotton and merchandise to and from all points east and north in competition with our local railroads, thus increasing very materially the amount of business to our boats, and enabling the merchants on the river to compete in freights with other points not so favorably located.

C. E. HOCHSTRASSER,
Vice-President Columbus Board of Trade.
E. L. WELLS,
Secretary Columbus Board of Trade.

COLUMBUS, GA., *July*, 1886.

O 4.

IMPROVEMENT OF OOSTENAULA AND COOSAWATTEE RIVERS, GEORGIA.

No work has been done on either of these rivers during the fiscal year ending June 30, 1886, nor in fact since active operations were suspended on the Coosawattee in October, 1880, and on the Oostenaula in August, 1881.

As there is now a fair channel for light navigation at moderate stages of the water, no further appropriation appears to be demanded by the interests of commerce.

Money statement.

July 1, 1885, amount available		$1,163 71
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$20 00	
July 1, 1886, outstanding liabilities	21 85	
		41 85
July 1, 1886, amount available		1,121 86

O 5.

IMPROVEMENT OF COOSA RIVER, GEORGIA AND ALABAMA.

In 1823 the State of Alabama passed an act to aid the improvement of the Coosa River. In 1828 Congress provided that any surplus of the grant for the Tennessee River should be applied to the improvement of the navigation of the Coosa and other rivers. In 1870 an act of Congress authorized an examination of the Coosa River between Greensport and the Selma, Rome and Dalton Railroad Bridge, a distance of 77 miles, and in 1872 an instrumental survey of this part of the river, upon which to base plans and estimates for its improvement. In 1875 an examination of the river was made from Rome, Ga., to Gadsden, Ala., a distance of 135 miles, when a plan for its improvement was adopted, which was subsequently modified, providing for a channel 30 feet wide and 3 feet deep at extreme low water.

In 1876 an appropriation was made for improving the Coosa River between Rome and the Selma, Rome and Dalton Railroad Bridge, which dates the beginning of the improvement of this river according to t present project. This project contemplates the improvement of t river between these points, overcoming the more serious obstructio by locks and dams and the lesser rock shoals and sand and gravel b by rock excavation and by works of contraction respectively. This pl has been carried out to the present time without material change modification.

This river has been navigated continuously between Rome and Green port since 1847, during high water, a distance of about 130 miles, the o structions consisting of the lesser shoals and bars. Just below Green port the Ten Island Shoals offered the most serious obstruction, givin a fall at low water of 24 feet in a distance of about 2 miles.

The expenditure of $417,396.06 up to the present time has resulted i the improvement of the water channel above Greensport by straighte ing it and widening it and increasing the depth from 16 inches to minimum of 2 feet. Below Greensport the work of lock and dam nav gation to overcome the more serious obstructions is nearly complete This will open the river to navigation as far down as the head of Brok Arrow Shoals, and was nearly completed during the past season wh the exhaustion of the appropriation compelled the abrupt cessation work.

During the past season, with the limited appropriation available, wor has been done as follows:

	Cubic yar
Earth removed at quarry	2
Stone quarried	7
Stone dressed	2
Stone transferred from quarry to river	71
Channel excavated (rock)	1

The condition of the work on June 30, 1886, was as follows:

Lock No. 1: Lock and dam completed and gates set up.

Lock No. 2: Masonry for lock and dam completed and gates frame

Lock No. 3: Masonry for lock (except coping) and dams complete and gates framed.

Lock No. 4: Stone quarried and dressed, except coping.

During the month of April, 1886, the Oosa River, in the vicinity o this work, rose to a height of 6½ feet above the highest known watermark up to that time. Very little damage was done to the work beyond the floating off of some of the gate-timbers, the greater part which were recovered, and dislodging a small quantity of riprap-ston The total damage is estimated at $1,100.

This work has been in charge of Assistant Engineer M. T. Singleto

The funds remaining on hand, together with the appropriation aske for, can be profitably expended during the fiscal year ending June 3 1888, in continuing the improvement between Rome, Ga., and the Selm Rome and Dalton Railroad Bridge, Alabama.

The value of the working plant upon this improvement is estimate at $6,895, but the work is of such character that a trifling increase i the plant is sufficient to increase very greatly the amount of work With the present working plant, worked to its full capacity, an annu expenditure of $75,000 is required; a less expenditure with the prese working plant is injudicious. With an increase of plant, the completion of the work within the limits of the present project can be effect by an expenditure of $150,000, unless extraordinary delays should incurred in the acquisition of title to the land.

The original estimate of cost of this improvement is $560,663. To this must be added the cost of improving about 29 miles of the river between Greensport and Gadsden, not included in any survey or estimate; also the increased cost of the better class of work adopted in the construction of the locks and dams, as well as the cost of removing obstructions which accumulate annually in the river channel, and the maintenance of the works. Below Greensport the improvement is of a permanent character, consisting of locks and dams. Above Greensport the river has generally a moderate slope and banks not easily eroded, but in places a movable bottom, where works of contraction are required. The improvement of this part of the river will have that degree of permanence which attaches to works of contraction under such circumstances. An annual expenditure will be required for removing obstructions from the channel and for maintaining the works.

The census of 1880 gives, for the counties bordering upon this river, within the limits of the proposed improvement, a total assessed valuation of real and personal property amounting to $15,232,350 and a total taxation of $199,878.

The primary object of this improvement is to open the river from Rome to the Coosa coal-fields, in the vicinity of Broken Arrow. The present local business on the river is therefore an incomplete exhibit of the importance of this improvement.

Money statement.

July 1, 1885, amount available		$21,862 12
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$21,058 18	
July 1, 1886, outstanding liabilities	1,254 41	
		22,312 59
Amount appropriated by act approved August 5, 1886		45,000 00
Amount (estimated) required for completion of existing project		96,968 00
Amount that can be profitably expended in fiscal year ending June 30, 1888		97,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.		

COMMERCIAL STATISTICS.

An effort has been made to obtain commercial statistics from parties presumably interested in the navigation of this river; but no information has been received. The statistics for 1885 are as follows:

The following is a list of the boats employed on the river:

Name.	Length at water-line.	Beam.	Tonnage.
	Feet.	*Feet.*	
Sidney P. Smith	187	28	83.40
Gadsden	164	30	133.66
Joel Marable	140	20	97.75
Hill City	140	18	75.75
To be completed by September 15, 1885	175	34	250.00

During the year ending June 30, 1885, these boats carried freight as follows:

Cotton	bales	$25,000
Grain, hay, and flour	tons	3,500
Guano	do	2,500
Miscellaneous merchandise	do	5,000
Lumber	B. M., feet	4,500,000
Passengers	number	8,500

In addition to the above, about 24,000,000 feet, B. M., yellow pine lumber was rafted to the mills on the river.

O 6.

IMPROVEMENT OF THE CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA.

The Chattahoochee River rises in the northern part of Georgia, flowing past the town of Columbus, the proposed head of navigation, where the river forms the boundary line between Georgia and Alabama, and the town of Eufaula and other towns to Chattahoochee, Fla., where it unites with the Flint River to form the Apalachicola. The present plan of improvement, adopted in 1873, contemplates a low-water channel 4 feet in depth and 100 feet in width from Columbus, Ga., to Chattahoochee, Fla., a distance of 223½ miles by the removal of snags and other obstructions from the channel and overhanging trees from the banks, by cutting a channel through the rock shoals and deepening sand-bars by scour.

The expenditure up to the present time of $188,857.40 has resulted in securing a fair navigable channel between Chattahoochee and Eufaula at all seasons of the year, and between Eufaula and Columbus at all times except during the prevalence of extreme low water.

The following table exhibits the condition of the improvement on June 30, 1886:

Table showing the condition of the improvement on June 30, 1886.

Number of shoal.	Name of place.	Below Columbus, Ga.	Above Chattahoochee, Fla.	Original depth.	Present depth.	Original width.	Present width.	Remarks.
		Miles.	*Miles.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
1	South Commons	1	323	2	4	300	100	Brush jetties.
2	Mound Bar	7	217	2½	4	350	150	Do.
3	Abercrombie's Bar	8	216	1½	4	350	150	Do.
4	Woolfolk's Bar	10	214	1½	4	500	150	Brush jetties and shore pro- tions.
5	Upatoie	11	213	2	4	300	150	Brush.
6	Little Shoals (Uchee)	17	207	2	4	29	65	Marl blasted and removed.
7	Reef below shoal	17½	206½	1½	4	50	60	Do.
8	Slick Bluff Shoal	18	206	0	4	39	70	Do.
9	Middle Rock	18½	205½	1½	4	30	100	Do.
10	Big Uchee Shoal	19	205	1½	4	29	80	Do.
11	Old Head of Uchee	19½	204½	1½	4	40	......	Do.
12	Betton's Upper Rocks	20½	203½	......	4	40	180	Hard rocks blasted and remov
13	Betton's Lower Rocks	21	203	......	4	50	200	Do.
14	Cody's Rocks	22	202	1	4	40	100	Do.
15	Shell Creek Bar	24	200	3	3	350	350	Shore protection.
16	Culpepper's Island	32	192	2	4	400	100	Jetties, marl reef blasted and re- moved.
17	Hardridge's Shoal	112	111	2	4	35	100	Hard rock blasted and remov

Numbers 6, 7, 8, 9, 10, and 11 constitute Uchee Shoals, about 3 miles long, number 11 being worked on at close of the season.

During the past fiscal year a new steam snag-boat has been completed and equipped for work on the Chattahoochee River at a total cost of $12,000, the engines, machinery, and other parts of the old boat having been introduced into the new one, except such as were found to be worthless.

Forty-six logs, snags, and trees were removed from the channel. The principal work done has been the excavation of a channel through chee Shoals, where 4,473¼ cubic yards of rock and 11 cubic yards of nd have been removed, the distance worked over at that point being 000 feet.

The funds remaining on hand, together with the appropriation asked r, can be profitably expended in continuing the work of excavation pon the rock-reef between Eufaula and Columbus, and in the employent of the new snag-boat for the removal of logs and other obstructions. he work has been in charge of Assistant Engineer P. M. Slaughter.

The value of the working plant upon this improvement is estimated t $20,002. When worked to its full capacity an annual expenditure f $20,000 is required; a less expenditure with the present working lant is injudicious. With an increase of plant about $40,000 can be rofitably expended during the fiscal year ending June 30, 1888.

The original estimate of cost of this improvement is $385,247.66. The imited appropriations available have compelled slow progress of the ork, and have added the annual accumulation of obstructions, due to reshets in the river, to the amount of work contemplated in the original stimate. There has also been added the cost of maintenance of works f contraction, and of their extension, made necessary by the works hemselves.

This improvement is at several points of a permanent character, the ottom of the river being of rock, and the banks not subject to erosion. At other points the river has a movable bottom and caving banks, and he improvement will have, with an annual expenditure for maintenance nd repair, that degree of permanence which works of contraction can ive to such a stream.

The census of 1880 gives for the counties bordering upon this river ithin the limits of its contemplated improvement, a total assessed valuation of property, real and personal, of $20,272,775, and a total taxaion of $271,573.

Money statement.

uly 1, 1885, amount available		$30,755 65
uly 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$16,594 08	
uly 1, 1886, outstanding liabilities	5,095 87	
		21,989 95
uly 1, 1886, amount available		9,065 70
mount appropriated by act approved August 5, 1886		20,000 00
mount available for fiscal year ending June 30, 1886		29,065 70
Amount (estimated) required for completion of existing project		162,228 69
Amount that can be profitably expended in fiscal year ending June 30, 1888		40,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

Abstracts of bids received and opened November 30, 1885, for building a steam snag-b for the improvement of the Chattahoochee River, Georgia and Alabama.

No.	Names of bidders.	Price.	Time of commencing.	Time of completion.	Where del ered.
1	M. A. Sweeney & Bro., Jeffersonville, Ind.	$8,750	Not stated	Not stated	Jeffersonv Ind.
2	Charles Y. Abercrombie, Montgomery, Ala.	11,650	30 days after notification of approval of contract.	Within four months after commencing work.	Mobile, Al
*3	Edward J. Howard, Jeffersonville, Ind.	8,775	Not stated	Not stated	Jeffersonv Ind.
†4	Rittenhouse Moore, Mobile, Ala.	13,500	....do	Not stated	Not stated.
*5	William Foster and August Kling, Mobile, Ala.	11,998	30 days after notification of approval of contract.	Within four months after commencing work.	Chattah ochee, Fla.

* No seals and no plan of capstan submitted. Erasures not explained.
† No plan of capstan submitted.

NOTE.—Before opening any other bid the bidder who was present was permitted to file a su mentary paper supplying an omission as to the time of commencing and completing the work bid Interlineations in bid not explained.

COMMERCIAL STATISTICS.

Number of steamboats employed in the commerce of this river	
Valuation	$124,
Tonnage	1,
Draught, in feet	2 t

During the year ending June 30, 1886, these boats carried in freight as follows:

Commercial fertilizers	tons	9,
Iron	do	
Cotton	bales	52,
Grain	bushels	189,
Lumber	feet	250,
Merchandise	bales	2,
Merchandise	barrels	662,
Live stock	head	
Total valuation		$8,440,
Total valuation of freights		90,
Total valuation of passenger traffic		36,
Aggregate valuation of river business		8,567,
Aggregate value in 1885		7,945,

The large increase in our river's business for the present year is mainly caused the improved condition of the river as caused by Government appropriations, t enabling our boats to run the year through, and by connections with railroad poi below to offer through rates for cotton and merchandise to and from all points e and north in competition with our local railroads, thus increasing very materi the amount of business to our boats, and enabling the merchants on the river to co pete in freights with other points not so favorably located.

C. E. HOCHSTRASSER,
Vice-President Columbus Board of Trade.
E. L. WELLS,
Secretary Columbus Board of Trade.

COLUMBUS, GA., *July*, 1886.

O 7.

IMPROVEMENT OF ALABAMA RIVER, ALABAMA.

.s stream is formed by the junction of the Coosa and Tallapoosa ;, 18 miles above Montgomery, Ala., in the central portion of the , and flows southward past the town of Selma, uniting with the ›igbee to form the Mobile River, which empties into Mobile Bay. river, with its principal tributary, the Coosa, now under improve- , offers a continuous line of water transportation from Rome, Ga., e Gulf of Mexico, flowing through the coal and iron deposits of ama and the cotton belt.

e plan of improvement for the Alabama River, adopted in 1870, ·mplates a channel 200 feet in width and 4 feet in depth at low- r from its mouth, 50 miles above Mobile, Ala., to Wetumpka, Ala., :ance of 323 miles. Before the improvement was commenced, the nel had a lowest depth of about 2 feet on some of the shoals, and ›bstructed by snags and overhanging trees.

e expenditure up to June 30, 1886, of $129,714.12, has resulted in ing 20 miles of the lower river, below the cut-off, before inaccessi- uring low water, and rendering that part of the river below Mont- ·ry, Ala., easy of navigation during ordinary low water.

ring the past fiscal year but little work could be done, except the ıg of snags and logs washed in since the previous season over the ·orst portion of the river, the appropriation being insufficient for urther extension of the work of improvement. An excellent work- lant for this river is on hand, and with sufficient appropriations ›e made to do efficient work. In the absence of such appropria- , this plant will decay before any adequate return has been had for xpenditure in providing it. The work done was principally in the ity of Gardner's Island, between Montgomery and Selma, at which ; a brush dam was constructed, closing one of the chutes and con- ating the water into a new channel, offering a greater assurance of anency.

ntinued high water interfered quite seriously with operations during ·ast fiscal year. The work has been in charge of Assistant En- :r J. E. Turtle.

is proposed to expend the funds remaining on hand and the appro- ion asked for in the employment of the present working plant for emoval of snags and other obstructions from the channel, and in ›onstruction and repair of contraction works upon other shoals in river.

e value of the working plant upon this river is estimated at $19,995. n worked to its full capacity an annual expenditure of $20,000 is re- :d; a less expenditure with the present working plant is injudicious. ı a slight increase of plant about $40,000 can be profitably expended ıg the fiscal year ending June 30, 1888.

e original estimate of cost of this improvement is $229,741. The of removing the annual accumulation of obstructions in the river nel, due to freshets, has been added to the work contemplated by ·stimate, as well as the cost of renewing and extending works of ·action. The river has, generally, a movable bottom and caving s. The improvement will have, with an annual expenditure for ıaintenance of the work, that degree of permanence which can be ı to such a stream by works of contraction.

e census of 1880 gives for the counties bordering upon this river, within the limits of the proposed improvement, a total assessed val tion of real and personal property amounting to $25,520,752, and a to taxation of $461,681.

COMMERCIAL STATISTICS.

Letters were addressed to parties presumably interested in the na gation of this river, and competent to furnish commercial statistics, b no information has been received.

Money statement.

July 1, 1885, amount available		$6,003
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$5,717 88	
July 1, 1886, outstanding liabilities	65 75	
		5,783
July 1, 1886, amount available		220
Amount appropriated by act approved August 5, 1886		15,000
Amount available for fiscal year ending June 30, 1887		15,220
Amount (estimated) required for completion of existing project		84,741
Amount that can be profitably expended in fiscal year ending June 30, 1888		40,000
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.		

O 8.

IMPROVEMENT OF TALLAPOOSA RIVER, ALABAMA.

This river rises in the northwestern part of Georgia and flows i southwesterly direction past the town of Tallassee to the Alab River, a short distance below Wetumpka. It has a fine water-pow at Tallassee, which has been partially utilized by mills at that poi and below this flows through a fine agricultural country.

The plan of improvement, pursuant to an examination and part survey of this river made by an act of Congress approved June 1 1880, contemplates obtaining a navigable channel from the mouth the river to the foot of Tallassee Reefs, 2 miles below the town of T lassee, a distance of 48 miles, with a least depth of 3 feet and width 60 feet at low water. This is to be accomplished by the removal snags, logs, &c., from the channel, cutting overhanging trees from t banks, the cutting of the prescribed channel through the rock-reefs a the removal of bars by works of contraction.

The expenditure up to June 30, 1886, of $23,441.46 has resulted i the partial improvement of the channel in the lower portion of t river, but the work has not progressed sufficiently to affect navigati

During the past fiscal year 2,423 snags, logs, and overhanging tr were removed, clearing the river of obstructions for a distance of 1 miles. Continued high water interfered quite seriously with operatio

The work was in charge of Assistant Engineer J. E. Turtle.

It is proposed to apply the amount on hand and the appropriat asked for to the employment of the present working plant in the moval of snags and logs from the channel and cutting overhang trees, in continuation of the present method of improvement.

The value of the working plant upon this river is estimated at $6,9 When worked to its full capacity an annual expenditure of $15,00 required; a less expenditure with the present working plant is inju sions. With an increase of plant about $30,000 can be profitable expended during the fiscal year ending June 30, 1888.

The original estimate of cost of this improvement is $40,125. To this must be added the cost of removing obstructions brought into the river channel by freshets since the date of the original estimate. This river, within the limits of the proposed improvement, has generally a movable bottom and caving banks, with, however, a moderate slope. The improvement will have that degree of permanence which can be given by works of contraction to rivers having such characteristics. An annual expenditure will be required for the removal of obstructions constantly accumulating in the channel and for the maintenance of the works.

The census of 1880 gives for the counties bordering upon this river within the limits of the proposed improvement a total assessed valuation of real and personal property amounting to $13,528,123 and a total taxation of $258,052.

COMMERCIAL STATISTICS.

It has been estimated that the falls at Tallassee, 2 miles above the upper limit of the proposed improvement, furnish a valuable water-power of about 6,000 horse-power, of which about one-eighth is now utilized, and that this improvement will furnish transportation for cotton and merchandise to the value of $1,700,000, and probably more, should the improvement of the river lead to a full development of the water-power at Tallassee. It is not known that any vessels have been employed in the navigation of this river during the past fiscal year.

Money statement.

July 1, 1885, amount available		$7,098 80
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$5,522 26	
July 1, 1886, outstanding liabilities	45 00	
		5,567 26
July 1, 1886, amount available		1,531 54
Amount appropriated by act approved August 5, 1886		7,500 00
Amount available for fiscal year ending June 30, 1887		9,031 54
Amount (estimated) required for completion of existing project		15,107 00
Amount that can be profitably expended in fiscal year ending June 30, 1888		30,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.		

O 9.

IMPROVEMENT OF CAHABA RIVER, ALABAMA.

This river rises in the northwestern part of Alabama, flows in a southerly direction past the town of Centreville, and through the Cahaba coal and iron district, to the Alabama River at Cahaba, Ala. The principal object of its improvement is the development of the water-way for the output of the Cahaba coal and iron district. The plan of improvement adopted in 1883 contemplates a channel 60 feet in width and 3 feet in depth at low water from its mouth to the town of Centreville, a distance of 38 miles, by the removal of all obstructions from the channel, cutting through the rock-reefs, cutting overhanging trees, and removing bars by works of contraction.

The expenditure up to June 30, 1886, of $28,989.79, has resulted in th partial improvement of the river from its mouth to Centreville, adap ing it to high-water navigation. This is within a distance of 21 mil of Cane Creek, which is within the Cahaba coal-fields. For this section of the river lock-and-dam navigation has been proposed.

During the past fiscal year 1,516 snags, logs, and trees were removed, clearing the river of obstructions for a distance of 19¼ miles. Continued high water in the river interfered quite seriously with active operations.

The work has been in charge of Assistant Engineer J. E. Turtle.

It is proposed to apply the funds available and the appropriatio asked for in the employment of the present working plant for the remova of logs and snags from the channel and in cutting overhanging tree upon the banks.

The value of the working plant upon this improvement is estimate at $6,950. When worked to its full capacity an annual expenditure $15,000 is required; a less expenditure with the present working pla is injudicious. With an increase of plant about $30,000 can be profitably expended during the fiscal year ending June 30, 1888.

The original estimate of cost of this improvement is $195,000. Th annual accumulation of obstructions in the channel must be added t the work contemplated by this estimate, the river from Centreville t its mouth having generally a movable bottom and caving banks covere with timber. The improvement will have that degree of permanenc which can be given by works of contraction to a river with such characteristics of bottom and banks and having at several points a very steep slope. An annual expenditure will be required for the remova of obstructions and the maintenance of the works.

The census of 1880 gives for the counties bordering upon this rive within the limits of the proposed improvement, a total assessed valuation of real and personal property amounting to $9,118,034 and a tot taxation of $156,526.

COMMERCIAL STATISTICS.

It is not thought that any vessels have made use of this river durin the past fiscal year. It has been estimated that the improvement this river will furnish transportation for cotton and merchandise to th value of about $3,870,000, and that the saving to the planters adjacen to the river on their cotton crops alone will be $60,000 annually; tha with slackwater navigation above Centreville to Cane Creek the mai business of the river will result from the development of the immens coal, iron, and timber interests of the Cahaba Valley, but that this development will require an extension of the river improvement by system of slackwater navigation from Centreville to Cane Creek, a distance of 21 miles.

Money statement.

July 1, 1885, amount available		$5,197 9
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$4,187 76	
July 1, 1886, outstanding liabilities	49 50	
		4,237 2
July 1, 1886, amount available		960 7
Amount appropriated by act approved August 5, 1886		7,500 0
Amount available for fiscal year ending June 30, 1887		8,460 7

stimated) required for completion of existing project........$157,000 00
it can be profitably expended in fiscal year ending June 30, 1888 30,000 00
in compliance with requirements of section 2 of river and
ts of 1866 and 1867.

O 10.

ENT OF CONECUH-ESCAMBIA RIVER, FLORIDA AND ALABAMA.

ie name of Conecuh River, this stream rises in the southeast-Alabama and flows past the towns of Andalusia, Brewton, 1 to the Florida State line, where the name changes to Es-er, and the stream continues southward to Pensacola Bay. rough a very extensive lumber district of long-leaf yellow ibuting largely to the export trade of Pensacola.

of improvement for this river, adopted pursuant to partial ns and surveys made in 1878 and 1879, contemplates the re-iags and sunken logs and other obstructions from the chan-; cut-offs, and cutting through the rock shoals from the mouth in Pensacola Bay to Indian Creek, a distance of 273 miles, pose of facilitating the movement of logs and rafts down the ding at the same time facilities for steamboat navigation.

ine 30, 1886, the expenditure of $38,953.64 has resulted in channel through the bar at the mouth of the river, and in il of obstructions to navigation, so that at the present time navigable at ordinary stages of water for steamboats draw-of water from Ferry Pass to Skinner's Landing, a distance s, and for boats drawing 3 feet to the Alabama State line. point, the channel has been improved sufficiently to give in-ilities to the commerce of the river.

he past fiscal year, 10,943 logs, snags, and overhanging trees, ubic yards of rock were removed, clearing the river of ob-for a distance of 140 miles. This is a work which will require ttention and continued appropriations, fresh obstructions ght in annually by the freshets of winter and spring.

posed to apply the funds remaining on hand and the appro-ked for to the continuation of the work of improvement by il of logs, snags, and other obstructions from the channel, -offs, and cutting through rock shoals. The work has been of Assistant Engineer Hiram Haines.

ie of the working plant upon this improvement is estimated When worked to its full capacity, an annual expenditure of equired; a less expenditure with the present working plant ous. With an increase of plant, about $30,000 can be profita-led during the fiscal year ending June 30, 1888.

inal estimate of cost of this improvement is $87,430. The generally, a movable bottom and caving banks, bordered by wth of timber, with only an occasional rock shoal. The an-iulation of obstructions, due to freshets, has been added to ontemplated by the original estimate. The improvement will an annual expenditure for maintenance, that degree of per-hich can be given to such a river by works of this character.

ıus of 1880 gives, for the counties bordering upon this river, essed valuation of real and personal property amounting to and a total taxation of $118,767.

Money statement.

July 1, 1885, amount available		$9,
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$8,195 87	
July 1, 1886, outstanding liabilities	34 50	
		8,
July 1, 1886, amount available		1,
Amount appropriated by act approved August 5, 1886		12,
Amount available for fiscal year ending June 30, 1887		13,
Amount (estimated) required for completion of existing project		35,
Amount that can be profitably expended in fiscal year ending June 30, 1888		30,

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

During the fiscal year ending June 30, 1886, this stream has carried down 4, cubic feet of sawn timber, 1,008,000 cubic feet of hewn timber, 90,000 saw lo 3,500 cedar logs.

During the season of high water occasional trips were made by steamboats b Pensacola, Bluff Springs, and Andalusia, transporting merchandise and agric products.

O 11.

IMPROVEMENT OF CHOCTAWHATCHEE RIVER, FLORIDA AND ALA

This river rises in Southeastern Alabama, and flows in a southerl southwesterly direction past the towns of Newton, Geneva, and ville (the crossing of the Pensacola and Atlantic Railroad), emp into the Choctawhatchee Bay, whence Santa Rosa Sound connects i Pensacola Harbor. The river flows through a rich agricultural co in a region which contributes, by means of this river and Santa Sound, a large proportion of the lumber transported from Pens The States of Alabama and Florida have appropriated $40,000 h fore for the improvement of the river from Geneva to its mouth. present plan of improvement, made pursuant to an examination, authority of an act of Congress approved in 1871, and a subseque amination under an act approved March 3, 1879, was adopted in and modified in 1880, and contemplates the improvement of the from its mouth to Newton, a distance of 252 miles, so as to obtain water navigable channel.

The expenditure of $71,645.95 up to June 30, 1886, has resul giving 4½ feet of water in the channel, except during low water, as Jones's Old Ferry, 27 miles above Geneva, and 2 feet of water channel as far as Pates Creek at a medium stage of water. Durin water 4 feet can be carried to this point.

During the past fiscal year 8,787 snags, logs, and overhanging were removed, clearing the river of obstructions for a distance miles. The work has been in charge of Assistant Engineer Gould.

It is proposed to apply the funds remaining on hand and the priation asked for to the further improvement of this river by moval of logs and snags from the channel and cutting through rock hoals and removing bars by works of contraction.

The value of the working plant upon this improvement is estimated at 2,410. When worked to its full capacity an annual expenditure of 15,000 is required; a less expenditure with the present working plant injudicious. With an increase of plant about $30,000 can be profit- ly expended during the fiscal year ending June 30, 1888.

The original estimate of cost of this improvement as amended in 80 is $122,832. The limited appropriations have compelled slow ogress of the work, and the annual accumulation of obstructions, due freshets in the river, have been added to the work contemplated by e estimate. The improvement, with an annual expenditure for mainte- nce and repair, will have that degree of permanence which can be ven to a river with a movable bottom and caving banks.

The census of 1880 shows that in the several counties which border on this river the total assessed valuation of property, real and per- nal, is $1,446,636; and the total taxation, $24,278.

Money statement.

ly 1, 1885, amount available		$10,094 45
ly 1, 1886, amount expended during fiscal year exclusive of iabilities outstanding July 1, 1885	$9,740 40	
ly 1, 1886, outstanding liabilities	45 00	
		9,785 40
ly 1, 1886, amount available		309 05
ount appropriated by act approved August 5, 1886		15,000 00
ount available for fiscal year ending June 30, 1887		25,094 45
mount (estimated) required for completion of existing project		35,832 00
mount that can be profitably expended in fiscal year ending June 30, 1888		30,000 00
ubmitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.		

COMMERCIAL STATISTICS.

NEWTON, ALA., *July* 21, 1886.

EAR SIR: Your favor of the 9th instant received and contents noted. We would st respectfully state that we believe your commercial statistics for 1884 are ap- ximately correct, and we are sorry that we cannot add anything thereto, being olly unacquainted with the lower river.

here is some difficulty in stating actual figures, but will endeavor to state a few ts concerning Choctawhatchee River.

elieving the trade would justify, and the river carry, we had a first-class steam- st built (the M. H. Smith) of 200 tons capacity, which made two trips to Pates ek with cargo both ways, and we were in high hopes of permanent navigation to t point. After trial it was found impracticable on account of obstructions, *but in ase scarcity of water.*

* * * * * * *

here is little doubt that if the Smith could have run there would have been a good de the past season.

here is now only one little boat on the upper river, and her capacity is so small t the merchants cannot depend on her, which necessitates the wagoning of goods, of old, 30, 40, and 50 miles.

While we do not wish to misrepresent or attach undue importance, we candidly ieve there is not a river in your district that would give as great returns for the lay as the Choctawhatchee. We would respectfully refer you to the maps of Ala- na and Florida, which will show the extent of country adjacent, and which is hout transportation except on its waters.

* * * * * * *

These statements are only intended to represent the present and prospective situation of trade and country in proximity to the river between Caryville, Fla., and Newton, Ala., inclusive.

* * * * * * *

Yours, very respectfully,

J. R. KELLY,
President Choctawhatchee Transportation Company.

R. L. HOXIE,
Captain, United States Engineers.

Towns in proximity to the river, and would ship on it.	Area that would trade to the river, navigation being established.	Merchants at present.	People buying supplies and shipping in this territory at present.	Approximate value of goods, groceries, cotton, wool, fertilizers, &c., sold annually.	Expected increase in sale of goods, &c., on basis of navigable outlet on river.	Expected increase in fertility of soil by increased application of commercial fertilizers.
	Sq. miles.	*No.*	*No.*			
Newton*	350	6	5,000	$450,000	Tenfold	Threefold.
Ozark*	200	10	6,000	500,000	Twofold	Twofold.
Echo*	250	3	2,500	225,000	do	Do.
Headland*	350	6	5,000	450,000		
Dothan*	350	3	2,000	125,000	Twofold	Twofold.
Skipperville*	200	5	3,000	250,000		
Haw Ridge*	300	2	1,000	150,000		
Clintonville*	200	1	1,000	100,000	Twofold	
Elba*	550	10	7,000	600,000	One and one-half	Twofold.
Daleville*	200	1	1,000	150,000	Tenfold	Fivefold.
Geneva†	550	12	1,000	900,000	Fivefold	Twofold.
Ennola‡	200	2	5,000	200,000	do	Threefold.
Cerro Gordo§	600	1	1,000	200,000		
Caryville‖	600	2	3,000	2,500,000		
Total	4,900	64	52,500	6,800,000		

* Agricultural district.
† Timber and agricultural district.
‡ Turpentine and rosin district.
§ Logging district.
‖ Lumber district.

O 12.

IMPROVEMENT OF LA GRANGE BAYOU, FLORIDA.

The La Grange Bayou extends about 2 miles in a northeasterly direction from the north side and near the head of Choctawhatchee Bay, and into it flows Cedar Creek, a deep stream, from 90 to 160 feet wide, on which is situated the town of Freeport, 1½ miles above the bayou.

The plan of improvement adopted was made pursuant to an examination of this bayou in 1881, under an act of Congress approved March 3, 1881, and contemplates the deepening of the channel through the bayou so as to admit the passage of vessels drawing 4½ feet at mean low water, the work to be done by dredging.

Up to June 30, 1886, there has been expended on this work the sum of $2,000, allotted from the appropriation of $20,000 made by an act approved August 2, 1882, for the improvement of the Choctawhatchee River, Florida, the two improvements being closely related. The result has been to secure a channel 5 feet in depth at mean low water.

During the past fiscal year no work has been done, no appropriation being available. It is proposed to expend the appropriation asked for a widening the existing channel and in removing the remaining ob- ructions.

There is no working plant upon this improvement. It is thought that e amount asked for, $5,000, will be sufficient to afford proper facilities the commerce of this bayou.

The original estimate of cost of this improvement is $19,994.30. It thought that the improvement will be reasonably permanent.

The census of 1880 gives for the counties bordering upon La Grange ayou within the limits of this improvement a total assessed valuation real and personal property amounting to $244,506, and a total taxa- on of $3,362.

Money statement.

mount appropriated by act approved August 5, 1886	$2,000 00
mount available for fiscal year ending June 30, 1887	2,000 00
Amount (estimated) required for completion of existing project	3,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	3,000 00
Submitted in compliance with the requirements of section 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

A. J. Gillis and other merchants and residents of Freeport, Fla., state that the com- rce of La Grange Bayou annually, including lumber, timber, produce, and various rchandize, approximates $100,000.

That in this commerce and that of other tributaries of the Choctawhatchee Bay enty schooners, with an aggregate of 550 tons, together with numerous smaller craft, d a few steam vessels, are engaged.

O 13.

IMPROVEMENT OF PENSACOLA HARBOR, FLORIDA.

Pensacola Harbor, on the coast of Florida, is a deep-water harbor on e Gulf of Mexico, within which is an extensive naval establishment of he United States, and from which, during the last fiscal year, there eared 525 steamships and sailing vessels, aggregating 325,393 tons.

The improvement of this harbor was commenced in 1878, by the re- oval of certain wrecks forming obstructions to navigation. In 1879 survey was made for the purpose of ascertaining the extent and prob- ble cause of the shoaling of the main ship-channel at a point known the "Inner Bar," and pursuant to this survey, which was referred to he Board of Engineers on Fortifications and Harbor Improvements, a lan of improvement was adopted which contemplates the temporary elief of navigation by dredging a channel across the inner bar, and the reservation of the shore-line at the site of Fort McRee by the construc- on of jetties and shore protection, for the purpose of protecting the ite for defensive works, and preventing further changes in the tidal urrents, the channel to be dredged to a depth of 24 feet with a width not less than 300 feet.

The expenditure up to the present time of $192,223.99 has resulted, s to the channel, in obtaining a depth of 24 feet at mean low water ver the inner bar, with a width of 120 feet. This increased width and epth were not maintained by the tides, and the channel has required

redredging. On June 30, 1886, a least depth of 23 feet existed.
work of shore protection has resulted in arresting the process of
sion and advancing the shore-line about 250 feet, while the 12, 18
24 foot-curves of the western channel fronting this shore-line
also advanced. North of the work at Fort McRee the shore-lin
not materially changed, the point being held by the works. T
west of this point, towards the mainland, the shifting sand-banks
mark the entrance to the lagoon have moved southward, and ar
great extent covered by the débris of the fort which has been w
around. This work may be regarded as permanent when the jetti
protected by suitable coping and slope protection. It would pro
require after that only very slight annual repairs. The channel
be dredged continuously during favorable weather, at a cost whi
estimated last year at $50,000, but which it is now thought will
siderably less.

During the past fiscal year active operations were suspended
this improvement, owing to the near exhaustion of the appropria
being necessary to retain sufficient funds to keep the works in
Repairs were made upon the shore protection during the months
tober and November, 1885, consisting of the renewal of the oute
head and restoring mattress work and ballasting; 55,354.71 cubic
of material were removed from the dredged channel by the s
dredge G. W. R. Bayley. The jetties were subjected to the ac
storms during the winter and more or less damaged by them. A
gale occurred on May 18, 1886, destroying the wharf, and on J
1886, and June 29, 1886, causing further injury to the outer e
jetty A and the shore protection. The work has been in charge
sistant Engineer Hiram Haines.

It is proposed to apply the funds remaining on hand, and the
priation asked for, to the completion of the works of shore prot
at the site of Fort McRee in such manner as will make them reas
permanent, and to the continuance of the work of dredging the
bar for the relief of navigation. Up to this time the works of
protection, having been of a tentative character, are perishable an
be promptly strengthened, or they will be destroyed, with the re
loss of every advantage gained hitherto. These works are expo
the action of violent storms from the Gulf, the waves which brea
the shore at this point having great destructive power.

The value of the working plant upon this improvement is esti
at $2,250. By the use of this plant, the existing works of sho
tection may be expeditiously completed in a permanent manner,
their further extension a question for the future. It seems to be
ter of great importance to secure, at once, in this manner, what
ready been gained. No working plant is available for the w
dredging in the harbor, which must be done under contract or
hire of a suitable plant.

Forty thousand cubic yards of sand will have to be removed t
plete the existing project for the temporary relief of navigation, i
ing the material which has silted into the dredged channel. It
sirable, if only in the interest of economy, to complete this in a
working season.

The ultimate cost of this work is not estimated in the origina
ect, which assumes that it will exceed $150,000. It is now est
that $40,000 will be required for completion, making the total
the work $235,000. At the date of the original project the pr
channel required the removal of 36,000 cubic yards of sand.

42,000 cubic yards have been removed, and 40,000 cubic yards re-
o be excavated. The cost of maintenance depends upon the rate
ch the dredged channel will continue to fill, and the cost of main-
; the works of shore protection in their exposed position at Fort
. This cost enters largely into the expenditures up to the present
ot only for redredging the channel, but for restoring the shore
ion. The rate of silting up in the channel appears to have di-
ed since the shore-line has been held by the works at Fort McRee.

Money statement.

885, amount available		$31,800 29
886, amount expended during fiscal year, exclusive of ies outstanding July 1, 1885	$29,024 28	
886, outstanding liabilities	330 00	
		29,354 28
886, amount available		2,446 01
appropriated by act approved August 5, 1886		20,000 00
available for fiscal year ending June 20, 1887		22,446 01
t (estimated) required for completion of existing project		20,000 00
t that can be profitably expended in fiscal year ending June 30, 1888		20,000 00

tted in compliance with requirements of section 2 of river and
or acts of 1866 and 1867.

COMMERCIAL STATISTICS.

port trade of this harbor is principally carried on in vessels of large capacity
equently deep draught, the principal article of export being a bulky mate-
ber and timber.

pacity of these vessels sometimes exceeds 1,800 tons; for this reason a con-
depth of water over the bar is desirable.

; the past fiscal year there were entered at the port of Pensacola 516 vessels,
ggregate tonnage was 319,407 tons. There were cleared 525 vessels, whose
e tonnage was 325,393 tons. In the traffic of Pensacola Harbor 112 steamers
ng vessels were employed.

were exported 8,825 bales of cotton, and 107,701,000 feet, B. M., of lumber and

---

Value of imports and exports.

Direction.	1886.	1885.	Remarks.
exports to foreign ports	$2,184,068	$1,967,275	There has been a large increase in coastwise imports, especially of fertilizers and guanos.
xports to coastwise ports	827,890	806,635	
l value of exports	3,011,958	2,773,910	
mports from foreign ports	150,237	9,912	
imports from coastwise ports	(*)	536,682	
l value of imports	150,237	546,594	
e of imports and exports	3,171,195	3,320,504	

* No record.

Custom-house receipts.

Description.	1886.	18
Duties on imports	$5,369 41	$9,
Tonnage tax	13,595 46	8,
Marine hospital tax	3 84	
Fines, penalties, and forfeitures	....	
Inspection of steam vessels	190 00	
Immigrant fund	16 00	
Official fees	3,117 59	2,
Miscellaneous	....	
Total	22,292 30	22,

APPENDIX P.

OVEMENT OF THE HARBOR OF MOBILE; OF WARRIOR, TOMBIGBEE, D BLACK WARRIOR RIVERS, ALABAMA, AND OF CERTAIN RIVERS IN SSISSIPPI—IMPROVEMENT OF CHANNEL TO BILOXI BAY, AND OF RN ISLAND PASS.

RT OF MAJOR A. N. DAMRELL, CORPS OF ENGINEERS, OFFICER IN ARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, WITH OTHER CUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

bile Harbor, Alabama.
arrior River, Alabama.
ombigbee River, from Fulton to Vienna.
ombigbee River, below Vienna.
ack Warrior River, from Tuscaloosa to Daniel's Creek, Alabama.
d Town Creek, Mississippi.
xubee River, Mississippi.
6. Pascagoula River, Mississippi.
7. Harbor at Biloxi Bay, Mississippi.
8. Horn Island Pass, Mississippi.
9. Pearl River, Mississippi, below Jackson.
10. Pearl River, Mississippi, from Jackson to Carthage.
11. Pearl River, Mississippi, between Edinburg and Carthage.

EXAMINATIONS AND SURVEYS.

ascagoula River, Mississippi, from the mills at Moss Point down to the anchorage in the bay, with a view to securing a uniform depth of 12 feet of water.
acissa River, Florida.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., August 6, 1886.

R: I have the honor to forward herewith annual reports for fiscal ending June 30, 1886, for the works of improvement under my ge.

Very respectfully, your obedient servant,

A. N. DAMRELL,
Major of Engineers.

he CHIEF OF ENGINEERS, U. S. A.

P 1.

IMPROVEMENT OF THE HARBOR AT MOBILE, ALABAMA.

he improvement of the channel of the harbor at Mobile, Ala., was n by the General Government in 1827, the depth of water then g 5½ feet through Choctaw Pass and 8 feet on Dog River Bar.

The appropriations from 1827 to 1857 were as follows:

By act of Congress May 20, 1826	$10,00
By act of Congress March 2, 1829	20,00
By act of Congress June 23, 1834	10,00
By act of Congress March 3, 1835	17,9
By act of Congress March 3, 1837	50,00
By act of Congress July 7, 1838	50,00
By act of Congress August 30, 1852	50,0
	$217,9
By act of Congress March 3, 1857, relief claim	20,8
Total	$228,8

The result obtained was a channel 10 feet deep and 200 feet w through the pass and the same depth with an unknown width over bar. In 1860 the channel through the pass was found to have sho to 7½ feet, the depth of water on the bar remaining the same.

No further improvement was attempted until 1870.

From 1870 to 1875 the following amounts were appropriated for purpose of obtaining a depth of 13 feet:

By act of Congress July 11, 1870	$50,
By act of Congress March 3, 1871	50,
By act of Congress June 10, 1872	75,
By act of Congress March 3, 1873	100,
By act of Congress June 23, 1874	100,
By act of Congress March 3, 1875	26,
Total	401,

This amount was expended in dredging a channel 13 feet deep 300 feet wide from the mouth of the Mobile River through "Choc Pass," and in deepening and extending that through "Dog River Bar" the 13-foot curve in the bay. The work was completed in Septem 1876, and the channel remained practically as it was dredged until commencement of the present project, February 19, 1881.

In 1878 a survey was directed to be made in order to deter whether the existing channel could be improved to a depth of 22 and for this purpose Congress, by act of June 18, 1878, appropri the sum of $10,000.

The survey was made and a report was submitted to the Chief of gineers suggesting several plans of improvement. In March, 188 was finally decided to continue the former improvement by dredgin a depth of 17 feet with a uniform width of 200 feet from the 17- curve in Mobile River to the curve of the same depth in the lower the estimated cost being $820,000.

From 1878 to June 30, 1885, the following amounts have been ap priated:

By act of Congress June 18, 1878 (survey)	$10
By act of Congress March 3, 1879	10
By act of Congress June 14, 1880	12
By act of Congress March 3, 1881	10
By act of Congress August 2, 1882	12
By act of Congress July 5, 1884	20
Total	66

Under authority of the act of March 3, 1879, bids for dredging called for and opened May 20, 1880, but all, being considered too were rejected and the work readvertised. In the mean time, Jun 1880, Congress appropriated an additional amount of $125,000, an contract for the total amount of $225,000 was awarded to George C. Fobes & Co., of Baltimore, Md., at 12.3 cents per cubic yard, the lowest bid under the previous call being 24.9 cents.

The contractors commenced work February 19, 1881, and completed their contract November 9, 1882, removing, in accordance with the terms of the contract, 1,610,804 cubic yards. The sum of $100,000 was further appropriated March 3, 1881, and the contract awarded to G. L. Long, of Mobile, Ala., at 11.7 cents per cubic yard. He commenced work on March 21, 1882, and finished January 24, 1884, the contractor having removed 724,730 cubic yards.

On August 2, 1882, the sum of $125,000 was appropriated, and the contract awarded to R. Moore, of Mobile, Ala., at 12.3 cents per cubic yard. The work was begun January 24, 1883, and finished February 9, 1884, the contractor having removed 888,093 cubic yards.

Congress, by act of July 5, 1884, appropriated the sum of $200,000 to continue the improvement, and the contract was awarded to Mr. Tobias Burke, of Mobile, Ala., at 9 cents per cubic yard. The work was commenced September 19, 1884, and finished June 15, 1886, 1,920,438 cubic yards being removed under this contract.

No further appropriation having been made, and the funds available exhausted, work on the improvement was suspended June 15, 1886.

TOTAL AMOUNT OF MATERIAL REMOVED FROM THE CHANNEL UNDER PRESENT PROJECT FROM FEBRUARY 19, 1881, TO JUNE 15, 1886.

	Cubic yards.
Under contract with George C. Fobes & Co	1,610,804
Under contract with G. L. Long	724,730
Under contract with R. Moore	888,093
Under contract with Tobias Burke	1,920,438
Total	5,144,065

The progress of the improvement of the channel from Mobile to the anchorage in the lower bay during the fiscal year ending June 30, 1886, was as follows:

First. Total number of cubic yards of material removed, 623,597.

Second. Cut No. 5 was dredged from a point 2,266 feet south of cluster of piles No. 35 to Cluster No. 38, a distance of 6,074 feet, and from a point 1,112 feet south of Cluster No. 40 to 600 feet south of Cluster No. 50, or to the curve of 17-foot depth in the lower bay, a distance of 27,318 feet, thus completing this cut from the elbow at the Fowl River Light to the southern entrance, a distance of 10 miles.

Third. Cut No. 4 was extended south from a point 1,250 feet below the upper gap of obstructions to a point 5,287 feet below the lower gap of obstructions, a distance of 9,753 feet, also from Cluster No. 30 to Cluster No. 31, on the Fowl River Reefs, a distance of 1,847 feet, making a total length of 11,600 feet = $2\frac{19}{100}$ miles.

Fourth. Several portions of the channel were redredged, as follows:

Cut No. 2, Clusters 30, 31, Fowl River Reefs, a distance of 1,847 feet, and 15,268 cubic yard removed.

Cut No. 3, on Dog River Bar, between Pile No. 10 and Cluster No. 7, a distance of 6,212 feet, and 46,590 cubic yards removed.

Cut No. 5, from Cluster No. 38 to 1,112 feet south of Cluster No. 40, a distance of 6,568 feet, and 60,739 cubic yards removed.

In the mouth of Mobile River Cuts No. 1, 2, 3, and 4 were redredged, and the aggregate distance of the four cuts equaled 4,470 feet, and number of cubic yards of material removed was 24,959.

The total length of the cuts redredged 19,097 feet=3.617 miles; total number of cubic yards of material removed 146,656.

From surveys made during the years 1885 and 1886 the conditio the channel was found to be as follows:

First. Commencing at the 18-foot curve, in Mobile River, the cour the channel bears south 40° 59′ east (true course) to the second cl of piles, located near the end of the Pinto Island Spit; at this cl the direction is deflected 15° 27′ to the left, and bears south 56° 26′ to the upper gap of the obstructions. This portion of the channe what is known as "Choctaw Pass," and is $\frac{73}{100}$ of a mile in length, h central depth varying from 18 feet to 23 feet, with a width between top of the slopes of 200 feet. It was dredged 19 feet deep and 145 wide. The character of the material is a mixture of sand and mud, a top layer of compact sand of 2½ feet in thickness.

In the fall of 1882 four cuts were dredged, with total width of 145 and depth of 19 to 20 feet, through this portion of the channel, and e subsequent examination showed an increased width and depth until spring of 1886, when one of the greatest freshets known in the hist of the State occurred in the rivers above. During May, 1886, an ex nation of the sand-bars in front of the city and of the upper portio the channel was made, and the depth of water on the bars was foun have increased, giving a continuous 17½-foot channel along the e city front, while at the mouth of the river the depth was diminishe 15½ feet on the crest and an average length of 1,112 feet.

This was removed during May and June of the present fiscal year, storing the channel to the depth and width obtained by dredgin 1882.

Second. At the upper gap of the obstructions an angle of 34° 6′ to right is made, the channel bearing south 22° 20′ east (true course) cluster of piles (No. 2) a distance of 993 feet. This portion was dred during 1881 and 1882 to a width of 245 feet and a depth of 18 to 19 An examination during February, 1886, shows a width between to slopes of 300 feet and a central depth of 20 to 21 feet. The materi a mixture of sand and mud in about equal proportions and easily moved.

Third. At Cluster No. 2 the course of the channel is further defle to the right 25° 58′, and bears south 3° 36′ west, to the lower gap in obstructions, a distance of 4,616 feet=$\frac{87}{100}$ of a mile.

This portion was dredged to a width of 105 feet and depth of 1 19 feet in 1881 and 1882, and prior to the removal of Cut No. 4, ing April, 1886, had a width between top of slopes of 150 feet. No. 4 increases it to 190 feet, with a bottom width of 130 feet, and to 19 feet depth. The nature of material still as above.

Fourth. At the lower gap the direction is changed 11° 24′ to right, bearing south 15¼° west to cluster of piles (No. 5) at the north of the elbow, on Dog River Bar, a distance of 1.79 miles. From lower gap to 1.2 miles south, Cut No. 4 was removed during April May of 1886, giving a top width of 180 feet and central depth of to 19 feet, and for the remaining $\frac{77}{100}$ of a mile the top width is 140 and central depth of 17½ to 19 feet, and was dredged prior to 18 The material is a mixture of sand and mud, the proportion of sand gr ually getting less, until about a mile south of the lower gap it is pr tically free of it.

Fifth. At Cluster No. 5 the direction changes 10° 14′ to the le bearing south 5° west to Cluster No. 6, a distance of $\frac{26}{100}$ of a mile, forms what is known as the "Dog River Elbow."

The experimental cut of 100 feet width, 300 feet length, and 22 feet pth, recommended by the Board of Engineers in their report of Febuary 28, 1880 (page 1065, Part II, Report of the Chief of Engineers, 880), is located in this elbow, and was dredged as recommended in Sepmber, 1882. It was examined in February, 1884; then had a minium central depth of 20 feet, with a depth of 17 feet throughout a idth of 125 feet. In May, 1885, the central depth was from 18½ to 19½ et, with a depth of 17 feet for 125 feet in width. In January, 1886, the entral depth was 18½ to 19 feet and 17 feet for 110 feet width, and 165 et between top of slopes. The material is a stiff blue mud, comparaively free from sand or sediment.

Sixth. At Cluster No. 6 the direction again deflected to the left 10° 7′, bearing south 5¼ degrees east to Cluster No. 31, a distance of 12 63 iles. The nature of the material from Cluster No. 6 for about 5½ miles s stiff blue mud then for a half of a mile, or between Clusters No. 11 nd 12, the stiff mud substratum is covered by a layer of sand from 0 o 2½ feet in thickness; from Cluster No. 12 to No. 20, about 4 miles, the aterial is entirely free of sand. At Cluster No. 20 commences the reefs f Fowl River, formed of rotten oyster-shells in ridges, and extends to luster No. 29, about 4½ miles. From Cluster No. 29 to No. 31 the material s about the same as above the reefs. From Cluster No. 6 to No. 30, a istance of 12.28 miles, three cuts have been removed, 17 to 18 feet deep nd 105 feet wide. The distance between the top of the slopes is now bout 140 feet, with central depth of 17½ to 18½ feet.

From Cluster No. 30 to No. 31, a distance of $\frac{35}{100}$ of a mile, Cut No. 2 was edredged during December, 1885, and Cut No. 4 removed during Janary, 1886, for the purpose of giving deep-draught vessels a passing point. he top width is about 200 feet, with a bottom width of 170 feet, 18 feet eep.

Seventh. From Cluster No. 31 the course of the channel is deflected 2° 41′ to the right, bearing south 7½° west (true course) a distance of 10 iles to the curve of 17 feet in depth in the lower bay. Cluster No. 31 is t what is known as the "Fowl River Bend." This portion of the chanel is so located that the extreme orthern point of the curve of 22 feet ay be reached without further change in direction, with Sand Island ight in range of central line.

Five cuts have been dredged throughout this portion, and it has now central depth of 17½ to 18½ feet, with a top width of 200 feet. The ature of the material from Cluster No. 31 is a blue mud, gradually beoming soft to Cluster No. 45, about 7¼ miles, where it offers but little esistance to vessels of 1-foot greater draught than depth of water in hannel. The natural slope being very flat, and lateral currents, acording to direction of the wind, being at times very strong, considerble shoaling has taken place in this portion, and will continue to do so ntil a sufficient width is obtained.

[illegible] June 30, 1886.

[illegible]	Dredged, 1881–1886.			Examinat 1885–18	
	Length.	Width.	Depth.	Minimum top width.	Minimum
	Miles.	*Feet.*	*Feet.*		
[illegible] obstructions.	[illegible]	145	19.20	200	2
[illegible]	.9	245	18.19	300	3
[illegible]	.7	155	18.79	190	1
[illegible] Cluster No. [illegible]	[illegible]	145	18.19	150	1
[illegible] Lower [illegible]	2.40	175	18.19	140	17
[illegible]	9.35	185	18.19	200	17
[illegible]	19.5	......	......	......	..

[illegible] cross-sections of the dredged ch [illegible] year ending June 30, 1886, the amount of m [illegible] complete the improvemen [illegible] as at present projected, viz. 200 feet wi [illegible] mean low tide, is [illegible] cubic yards, and [illegible] filling the amount is [illegible]1,049 cubic yards, [illegible]

Locality.	Length and width to be dredged.		Depth=17 feet.	Dept fee
	Length.	Width.		
	Miles.	*Feet.*	*Cu. yds.*	*Cu.*
[illegible] Mobile River [illegible]	2	300	71,981	1
[illegible] Cluster No. 1	[illegible]	300	14,329	[illegible]
[illegible] obstructions	.7	40	29,643	4
[illegible] 200 feet south of Clus[illegible]	.55	40	33,487	4
[illegible] Cluster No. 4 to Cluster No. [illegible]	12.22	75	1,176,698	1,4
[illegible] Cluster No. [illegible]	.35	40	16,450	[illegible]
[illegible] 400 feet [illegible]	1.55	30	220,250	3
Total.	25.33	......	1,566,847	1,9

The condition of the channel previous to the commencement of present project was such that no vessel of greater draught than 12 could come to the city, but all such anchored in the lower bay, a tance of 28½ miles, and the cargoes were lightered or rafted to and f the city at a great expense and frequently at considerable loss of ca and time.

The channel of 17 feet depth with a width of 175 feet was opene October, 1882, and during the business season of 1882 and 1883 all sels entering the bay came up to the wharves of the port and there charged cargoes or ballast, then reloaded with full cargoes, or to a de of 16½ feet, and in some cases to 17 feet and 17 ½feet, but owing to vessels getting out on the slopes of the channel, thereby pressing material into the dredged channel and also causing delay to other vessels, it was deemed best to limit the draught to 16 feet until the channel was widened; the average draught therefore during 1883, 1884, and 1885, was 5½ feet. The width being increased during the fiscal year ending June 30, 1886, the draught of all vessels partially loaded at the wharves was between 15½ feet and 17 feet, the average being 16 feet, and in all cases passing through the channel without delay.

The depth of 17 feet at mean low tide was practically demonstrated on January 21, 1886, by the safe and quiet passage down the dredged channel of the British steamship Wandle. The draught of the vessel at anchor was 16.3 feet, the reading of the tide-gauges called for 15.8 feet in the channel, and the vessel with a full cargo of 4,137 bales of cotton (the largest cargo of cotton ever loaded at the wharves) passed down without any delay of any kind. Again, on May 29, 1886, the British bark Priscilla, partially loaded with cotton, drawing full 17 feet at anchor, passed down on an ebb tide, and when about half-way down the tide gauges read 1.1 foot below 17 feet.

During the winter of 1885–'86 a careful survey of Mobile River from the head of Spanish River to the gap in the upper obstructions was made, for the purpose of establishing wharf-lines on both east and west sides of the river. The improvement so far as it has progressed has given very general satisfaction. The amount available during the fiscal year ending June 30, 1887, will be expended in completing Cut No. 4, which will give a channel of 17 feet depth and minimum width at mean low tide of 186 feet, from the wharves of the port to the lower anchorage; also, in dredging Cut No. 5, from the 17-foot curve in Mobile River as far south as the funds at hand will permit.

The total amount that has been expended by the General Government toward increasing the depth of the channel of Mobile Harbor from 12 feet to 17 feet at mean low tide is $660,000, and the total amount since 1827 expended is $1,289,830.38, resulting in a gain of depth of 11½ feet, viz, from 5½ feet original depth in Choctaw Pass to a depth of 17 feet.

The immediate benefits to be derived from the improvement is the saving of lighterage and towage of cargoes of all vessels of draught exceeding 12 feet to and from the city a distance of 28½ miles; also, the far greater security and facility in discharging and loading either in part or fully the cargoes at the wharves of the city of Mobile.

The improvement is located in the collection district of Mobile, Ala. Mobile is the nearest port of entry and is situated at the northern entrance of the dredged channel 26½ miles from the southern entrance to the same, and 36 miles from the outer bar buoy in the Gulf of Mexico.

Money statement.

July 1, 1885, amount available	$75,840 61
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	74,927 83
July 1, 1886, amount available	912 78
Amount appropriated by act approved August 5, 1886	90,000 00
Amount available for fiscal year ending June 30, 1887	90,912 78
Amount (estimated) required for completion of existing project	80,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	80,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

The following statistical statement for the years 1885–'86 was furnished by the collector of customs of this port:

Description.	Entrances.						Clearances.					
	June 30, 1886.			June 30, 1885.			June 30, 1886.			June 30, 1885.		
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Cre
Foreign	109	75,003	1,468	124	73,713	1,458	121	83,947	1,670	136	87,466	1,74
Coastwise	54	24,509	507	37	11,128	241	45	16,316	348	45	8,187	[illegible]
American	34	8,172	252	47	17,369	330	46	12,571	353	38	19,068	[illegible]
Total	197	107,684	2,227	208	102,210	2,029	212	112,834	?,371	219	114,721	2,[illegible]

Imports and exports.

Description.	1886.	1885.
Duties on imports	$18,814 73	$7,513 97
Tonnage dues	3,912 84	3,438 [illegible]
Hospital collections	786 60	1,470 [illegible]
Miscellaneous	4,273 77	968 [illegible]
Total collections	27,787 94	13,391 [illegible]
Exports to foreign ports	2,834,654 00	3,015,082 00
Imports of foreign goods	69,433 00	129,046 00

Mobile Cotton Exchange statistics.

Articles.	1885–'86.	1884–'85.	1883–'84.
Cotton receipts:			
Via Alabama River ... bales	43,101	40,862	29,739
Via Tombigee River ... do	62,228	47,880	35,244
Via Warrior River ... do	10,452	5,333	5,864
Via Mobile and Ohio Railroad ... do	81,359	70,664	114,513
Via Louisville and Nashville Railroad ... do	56,380	65,142	68,716
Coastwise via Pensacola, Fla ... do	10,427	10,558	6,835
Total receipts	263,647	240,309	260,911
Coffee importations ... sacks	24,330	27,878	19,809
Naval stores:			
Rosin ... barrels	173,880	163,437	228,015
Turpentine ... do	38,351	37,487	43,228
Tar ... do	550	....	450
Pitch ... do	....	....	2,000
Salt importations:			
Imported from Liverpool direct ... sacks	19,988	....	29,597
Imported from Liverpool indirect ... do	....	....	1,986
Imported from Vermillion Bay, Louisiana ... do	....	....	....

Mobile Produce Exchange statistics.

Articles.	1886.	1885.	1884.	1881.
oysters … value..	$275,000	$250,000	$210,000	$150,000
s … do....	$175,000	$200,000	$232,480	$174,483
… pounds..	450,000	450,000	340,000	325,786
coal … tons..	30,594	30,310	19,598	8,189
ania and English coal … do....	1,519	573	891	2,701
… rolls..	32,539	20,939	18,471	9,257
s … bundles..	100,786	13,337	49,686	42,315
… casks..	14,383	7,856	7,482	8,829
… barrels..	115,069	109,003	100,079	90,013
… do....	3,152	4,447	5,084	5,773
… hogsheads..	3,053	2,362	3,926	4,035
… barrels..	5,644	6,204	5,945	7,954
… do....	1,934	1,268	2,439	1,874
… sacks..	137,251	88,193	97,433	57,062
… do....	331,102	245,010	370,417	345,307
… do....	63,250	47,491	55,491	43,996
… bales..	43,125	30,302	40,891	27,490
… boxes..	25,011	18,280	18,771	17,404

omparative statement of shipments of cotton to foreign and coastwise ports.

Direction.	1885–'86.		1884–'85.		1883–'84.	1880–'81.
	Bales.	Value.	Bales.	Value.	Bales.	Bales.
y vessel) …	47,421	$2,116,766	43,830	$2,308,581	57,537	46,366
(by vessel) …	16,250	723,125	25,559	1,346,958	16,353	………
y sail) …	199,976	8,898,932	190,095	10,016,006	186,991	224,894
l, …	263,647	11,738,823	259,484	13,671,545	260,911	271,260

ber and character of vessels engaged in the traffic of Mobile Harbor, Alabama.

ption.	1886.		1885.		1884.		1881.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
…	4	546	4	558	4	491	4	877
…	28	139	28	139	21	122	17	75
…	70	1,311	70	1,311	59	1,139	24	848
…	26	1,575	29	1,474	24	1,501	12	1,181
…	24	1,509	24	1,509	21	1,875	81	2,394
nacks....	11	346	11	346	10	314	6	170
…	163	5,426	166	5,337	139	4,942	94	5,540

[illegible] of timber, lumber, &c., shipped by vessel to foreign and coast ports.

[illegible]	1886.		1885.		188
	Quantity.	Value.	Quantity.	Value.	Quanti
[illegible]:					
[illegible], B. M.	18, 628, 549	$209, 278	15, 388, 808	$178, 622	11,
[illegible], B. M.	5, 835, 914	70, 030	6, 881, 895	75, 197	9,
[illegible], B. M.	24, 464, 463	279, 308	22, 270, 703	253, 819	21, 11
[illegible]:					
[illegible], B. M.	36, 416, 664	339, 878	37, 443, 672	385, 426	20, 3
[illegible], B. M.	385, 451	3, 212	....	....	12
[illegible], B. M.	36, 802, 115	343, 090	37, 443, 672	385, 426	20, 45
[illegible]:					
[illegible] ....number..	494, 950	2, 233	686, 800	1, 545	3, 90
[illegible] ....do....	685, 000	3, 425	900, 000	2, 025	2, 10
[illegible] ....do....	1, 179, 950	5, 658	1, 586, 800	3, 570	6, 0
[illegible]:					
[illegible] ....do....	92, 469	10, 468	94, 261	11, 947	91,
[illegible] ....do....	234, 216	....	150. 000	....	....
[illegible] ....do....	326, 635	10, 468	244, 261	11, 947	91,

[illegible] above statement was made up from clearances and such shipment by vess [illegible] licenses as could be obtained, but does not include any shipment [illegible] or railway to the interior, which is large.

Number of vessels entering and clearing at Mobile, Ala.

1881-1882.

[illegible]	In port June 30.	Tonnage.	Cleared.	Tonnage.	Cargoes.				Ballast.			
					Foreign.		Coast-wise.		Foreign.		Coast wise	
					In.	Out.	In.	Out.	In.	Out.	In.	O
[illegible]	....	....	3	1, 514	1	3	....	....	1	......	1	...
[illegible]	....	....	13	14, 802	1	12	1	......	10	......	1	
[illegible]	9	3, 632	78	51, 642	4	63	5	6	64	......	4	
[illegible]	....	....	23	6, 127	4	10	7	13	3	......	9	...
[illegible]	8	327	109	22, 675	24	50	17	53	9	1	67	
[illegible]	17	3, 959	226	96, 760	34	138	30	72	87	1	82	

1884-1885.

[illegible]	In port June 30.	Tonnage.	Cleared.	Tonnage.	Cargoes. Foreign. In.	Cargoes. Foreign. Out.	Cargoes. Coast-wise. In.	Cargoes. Coast-wise. Out.	Ballast. Foreign. In.	Ballast. Foreign. Out.	Ballast. Coast wise. In.	O
[illegible]	....	....	4	2, 076	....	.....	2	3		......	2	
[illegible]	1	1, 135	11	13, 326	....	11	....	......	12	......	....	...
[illegible]	3	2, 203	118	79, 061	18	107	1	6	97	......	7	
[illegible]	....	....	17	5, 284	3	16	1	......	12	......	1	
[illegible]	14	3, 015	142	29, 944	49	55	52	63	23	2	32	
[illegible]	18	6, 353	292	129, 691	70	189	56	72	144	2	43	

1885-1886.

[illegible]	In port June 30.	Tonnage.	Cleared.	Tonnage.	Cargoes. Foreign. In.	Cargoes. Foreign. Out.	Cargoes. Coast-wise. In.	Cargoes. Coast-wise. Out.	Ballast. Foreign. In.	Ballast. Foreign. Out.	Ballast. Coast wise. In.	O
[illegible]	1	757	18	8, 354	1	6	7	11	6	.....	5	
[illegible]	1	911	19	21, 440	1	18	...	......	19	1	.	...
[illegible]	3	1, 712	95	62, 742	5	89	3	4	83	1	4	
[illegible]		....	7	2, 452	1	5	2	1	4	......	....	
[illegible]	3	451	147	30, 709	29	54	66	75	17	4	24	
[illegible]	8	3, 831	286	125, 697	37	172	78	91	129	6	33	

P 2.

ROVEMENT OF WARRIOR AND TOMBIGBEE RIVERS, ALABAMA AND MISSISSIPPI.

WARRIOR RIVER.

he examination and partial survey of this river was made in 1874, l the report thereon may be found in the Report of the Chief of gineers for 1875, Part II, page 16.

n its original condition the river was well adapted for high-water vigation, having a width of 400 feet at Tuscaloosa, gradually reduc- to 150 feet near its mouth.

For an average period of five months, during the winter and spring, e navigable depth ranged from 10 to 40 feet, and the chief difficulty perienced was from overhanging trees, which sometimes carried away e chimneys of steamboats and damaged their upper works. Below a -foot stage snags began to be troublesome, and when, as summer ap- oached, the river receded to a stage 4 to 5 feet above low water, navi- tion for all practical purposes was brought to a close.

The obstructions to low-water navigation, rendering it impracticable, re:

First. Ninety-four bars and reefs that afforded generally a ruling pth of 18 to 30 inches, only, in some cases, shoaling to 12 inches.

Second. Numerous snags and sunken logs, occurring mainly in the rrow bar chutes, but frequently met with in the reaches also.

Third. Overhanging trees that, besides being troublesome in high ges, effectually closed narrow chutes, even had they been otherwise vigable.

The improvement of the Warrior was authorized by act of Congress March 3, 1875, and the project recommended and approved was to epen the bars, remove the snags, &c., and cut down the overhanging nber with a view of obtaining for small boats a low-water channel 80 t in width by 4 feet in depth.

The estimated cost of the improvement was $151,103.

The work was commenced in 1875, and has been prosecuted annually an average period of four months in each year, with results as hereafter given.

WORK FOR THE YEAR ENDING JUNE 30, 1886.

There being but about $6,000 available for the year's work only a small ce could be employed, which was stationed at Buzzard's Bar, 98 miles m the mouth of the river.

The work needed here was to slope and revet a caving bank.

The river here has a separate high-water and low-water channel. uring the high stages the main current is over the bar, and the summer channel being in quiet water fills up. As the water falls in the ring, there comes a time when, before the chute scours out, the water the bar becomes shoal and for a brief period there is no navigable annel, although the river is at a good boating stage, 6 to 8 feet above w water. Instances of this kind occur elsewhere, but the special fficulty in this case is that the receding bank (which has lost 200 feet ce 1874) and the advancing point just above the chute have made a ry abrupt turn necessary in order to enter the chute, and the case is gravated as the bank yields, threatening to make the entrance im- acticable for tows, if it is not already so.

The treatment proposed was to slope and revet the caving bank an afterwards to open a channel through the bar, allowing, and if necessary assisting, the summer chute to close up permanently.

As the thorough improvement of the river will require several mil of bank revetment, the work done here was somewhat experiment with a view to determine if a cheap method, without the use of ro (not generally obtainable), would answer the purpose. The meth tried was to slope the bank (slope 1½ or 2 horizontal to 1 vert), and the to cover with brush 1 foot thick, laid on in lapping courses like shingl Each course was held down by wires secured to stout pickets driv at 8 feet intervals by mauls, to a depth of 3 to 4 feet. The wires we stretched horizontally 6 feet apart. After standing for some time th pickets were again driven that the wires might press the brush close t the bank.

The brushing commenced at the top of the slope, the butts of eac course overlapping the tops of the preceding one, the object being t place the fine brush in contact with the bank to check the flow o water along the slope's surface. The theory assumed was that th current being checked by the rough brush surface would deposit it sediment upon and under it, forming a rich nidus from which woul spring a natural growth that in a few years would give a live and permanent brush protection, which once established, the decay of the wire brush would be of no consequence.

The cost of labor in sloping and revetting was—

For sloping banks	6.8	cents per square yar
For cutting and boating brush (1 mile)	5.0	cents per square yar
For making and driving pickets	1.6	cents per square yar
For laying and wiring brush	2.8	cents per square yar
Total	16.2	cents per square yar

At the above rates the cost of this work, with banks, as in this cas 25 to 30 feet high, would be about $6,000 per mile.

With a suitable force and equipment (including a hydraulic grade the cost would be materially reduced, probably to $4,000 per mile.

An examination of the above work in May, after its exposure to th winter floods, one of which was the highest known since 1833, indicat that the method used will succeed very well on this river. Here an there the brush had been a little disturbed (apparently by drift), and i one place it had been stripped from the bank (which was uninjure however), but nineteen-twentieths of the work was intact and had, a hoped, become well silted up, and the numerous buds and sprouts appearing indicated that a natural growth would become well started du ing the coming summer.

Besides the work above mentioned, 250 logs were removed from th channel between Buzzard's Bar and Jennings' Ferry, a distance of miles. Work closed on November 10 from exhaustion of funds, and th boats were floated down to Demopolis to lie up.

The original project called for the improvement of 94 bars and reef covering an aggregate distance of 14 miles out of a total length of riv (Tuscaloosa to Demopolis) of 140 miles. Forty-nine bars, occupying a aggregate length of 4.64 miles, have been worked upon during tho seasons in which the funds available were sufficient to equip and employ a force for this purpose.

The most essential work, and a necessary preliminary to bar improv ment, being the removal of snags and logs, together with the cutting o overhanging timber, the means at hand have been every year largely d in some seasons wholly, devoted to the prosecution of this work, ich has proved of much greater magnitude than expected.

The original estimate of snags to be removed, made from actual count those in sight, was a little less than 1,100, while up to this time over 00 have been taken out. More than 8,400 trees have also been cut m the banks. The work of removing snags and logs has been re- ted several times over a great part of the river. This has been de necessary from the obstructions caused by the trees that are ry year thrown into the river by land-slides and caving banks. It also happened in many cases that after clearing a chute from logs, er underlying logs, becoming disengaged, would after a while rise at end and form fresh obstructions.

The cause of this latter class of obstructions has nearly ceased to rate, but those of the others mentioned continue to act and will do until stability shall have been given to the banks. The work for purpose—sloping and revetting—was not originally contemplated, the necessity for it has become apparent not only to keep the chan- l free from snags, but to give permanency to the improvements made. It is thought that an aggregate length of 4 to 5 miles will cover the ount of bank revetment now needed.

The bars improved include all those that originally afforded a ruling pth of less than 2 feet. A deepening of 1 to 2 feet has been effected m scouring alone, induced by contraction of the channel. This con- ction has not yet been made less than 100 feet, and in most cases 5 feet.

In order to accommodate the coal tows from the Upper Warrior, as plained in last year's report, these widths should not be reduced. In ight reaches a channel laid along the bank with a width of 100 feet y suffice, but in bends and crossings the limit should not be less than 5 feet.

The improvements thus far made have lowered the navigable stage ly 3 feet. This was demonstrated practically last fall by a steamer hich made the trip to Tuscaloosa and returned with 600 bales of cot- n on a stage hardly 2 feet above low water, the boat drawing at the ne 4½ feet.

With a 125-foot channel a depth of 4 feet for the full width cannot be intained on a low-water stage. For small light-draught boats this annel can be made navigable at all times, but for tows requiring 5 to eet for the whole channel-width a stage of 4 feet above low water l probably be needed.

With open river navigation, improved as proposed, it is expected that river will afford safe and easy navigation throughout the year, ough during the low-water period the depth afforded will be sufficient ly for light-draught boats. For tows drawing 5 to 6 feet uninter- pted navigation may be expected for six months, with boating stages curring irregularly for three months more.

With the funds available for expenditure during the fiscal year end- g June 30, 1887, it is proposed to continue the work of bank revet- nts, and probably complete it so far as it is at present needed. In nnection with this work bar improvements and snagging will be car- d on to such an extent as the requirements of the other works will rmit.

This work, after completion, will require annual revision, for some ars at least, at a cost of $8,000 yearly.

The commercial advantages expected are—

First. The reduction of freight rates, in consequence of competition between river and rail, amounting, as estimated in former repo $50,000 annually on the present business of the Warrior Valley.

Second. Doing away with the uncertainty, irregularity, and in measure the risk heretofore attendant upon river transportatio consequently reducing its cost.

Third. The utilization of the river as a channel for coal transp tion to the Gulf.

Money statement.

July 1, 1885, amount available	$6,
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	6,
July 1, 1886, amount available	
Amount appropriated by act approved August 5, 1886	18,
Amount available for fiscal year ending June 30, 1887	19,
Amount (estimated) required for completion of existing project	34,
Amount that can be profitably expended in fiscal year ending June 30, 1888	34,
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

The business done on the Warrior and Tombigbee rivers during the fiscal ye ing June 30, 1886, as far as could be ascertained, was:

Warrior River, Alabama.

10,388 bales of cotton, valued at	$4
20,000 sacks of cotton-seed, valued at	
General merchandise (up freight)	2
Total	7

TOMBIGBEE RIVER.

The improvement of the Tombigbee in Mississippi was authoriz act of March 3, 1873, and its improvement below Columbus by March 3, 1875. Its continuance has been provided for by appropria made for the Warrior and Tombigbee jointly.

The act of July 5, 1884, made two divisions of the Tombigbee "Fulton to Vienna" and "Below Vienna." This distribution is ac ingly observed in this report.

In its original condition the river was navigated throughout the to Bladen Springs, the ordinary limit of tide-water, 143 miles fro bile. During low water, however, boats were liable to detention at bars, where at low tide the depth was sometimes reduced to 2 Moreover snags were troublesome, and at some points dangero that they could be passed only in daylight.

From Bladen to Demopolis, 243 miles from Mobile, low-water na tion was difficult both from bars on which the boats grounded, and snags and sunken logs. At times only 18 inches could be found on of the bars, and then the boats turned back at Bladen.

From Demopolis to Columbus, 416 miles from Mobile, there we merous bars affording only 12 to 18 inches at low water, and the ch throughout was much obstructed by snags. Overhanging trees troublesome on all stages of water, and often inflicted damage.

Navigation was carried on only in the winter and spring, the ter season, and ceased when the river fell to a stage 4 to 6 feet above w water.

From Columbus to Aberdeen, 481 miles from Mobile, navigation was ficult on a 12-foot stage; to Cotton Gin Port, 516 miles, it was practible for barges only, and to Fulton, 593 miles, there was no navigan at all.

The project adopted for improvement was to open a low-water channel of navigable width having a minimum depth of 4 feet to Demopk, and 3 feet thence to Columbus. From Columbus to Fulton the ver was to be cleared of snags and overhanging trees for its improvent during the boating stages, open river navigation at low water not ing considered practicable. The estimated cost of the improvement s $205,000.

The work was commenced in 1873, and the appropriation of $10,000 n exhausted. It was not resumed until August, 1878, since which e it has continued during the low-water seasons for an average anl period of five months.

The time spent upon the work has been mainly devoted to snagging l bank-trimming, which are essential preliminaries to bar improvent. A considerable amount of the latter work has also been done ing the three years in which the funds available allowed the employnt of a force for that purpose.

The work for the year ending June 30, 1886, was limited in its amount m the fact that only $3,912.01 were available for the upper division, l $3,058.17 for the lower. As one small force could easily work out h these amounts during the season, the snag-boat "Big B" only was ployed for the work on both divisions.

For the maintenance of the improvement above Columbus, however, ich during low water is not accessible for steamboats, a small skiff ty was engaged for a month in August and September in working r the river from Fulton to Aberdeen, 112 miles, in which fallen trees l slides had caused obstructions.

These were all removed, and the river left in a good navigable condin on a 4-foot stage, at a cost of about $500.

The "Big B" worked on the upper division from Vienna to the mouth Big Creek, 5 miles below Pickensville, a distance of 38 miles, of which niles was new work; 587 logs were taken out and 174 trees cut along e bank.

Commencing, then, at Vienna, on August 15, the "Big B" worked wn-stream for 250 miles, removing the logs and obstructions that had veloped in the past two years. Three hundred and seventy-eight logs re taken out and 174 trees cut. A wreck at the mouth of Sucamoee, which, owing to a shifting of the channel, had lately become a ficult obstacle to pass, was partially removed, leaving the channel ar. On the 20th of October work was suspended from exhaustion of nds, and the "Big B" was laid up in Mobile.

The present condition of the river is as follows:

First. *From Fulton to Vienna.*—From Fulton to Columbus, 177 miles, e proposed improvement has been completed, and the river is navible down to a stage of 4 feet above low water. From Columbus to ienna the river is navigable on a 2-foot rise for boats drawing 3 feet.

All of the river, except about 3 miles near Pickensville, has been well eared of logs, of which 4,280 have been taken out. Twenty bars that iginally afforded a depth of 12 to 20 inches have been improved and e depth increased to 3 feet. Five of these, however, have partially oaled again from runbars and will need further work. Fifteen bars of 18 to 24 inches depth remain unimproved, and prevent low-wa igation.

Second. *Below Vienna.*—Four thousand one hundred and fi snags and logs have been removed and the banks well trimmed hanging timber. This work, together with the bar improvement have given safe navigation with 3 feet depth at ordinary low Demopolis. On a 1-foot rise this depth can be carried to Kirkp 260 miles, and on a 2-foot rise to Vienna. Eight bars below olis, having originally a depth of 18 to 28 inches, have been im and a depth of 4 feet obtained, but in two cases the gain has be tially lost. In both cases the depth can be readily restored.

Between Demopolis and Vienna 14 bars have been improved, which a depth of 3 feet has been secured. Fifteen bars below D lis and 30 above remain to be improved before the channel wi the depth designed in the project. Until this is done the full be the improvements made will not be felt. The railroad bridge at Bluff gives a difficult and unsafe passage for descending boats sequence of a projecting rock bluff above the bridge which cl draw-opening and throws a cross current through the other.

It is proposed to use the funds available for expenditure du year ending June 30, 1887, above Vienna in completing the sn and bank trimming over the unfinished 3 miles below Pickensvi afterwards to take out the scattering logs that have accumul tween that point and Columbus during the past 2 or 3 years. provements will also be continued so far as the means affor permit.

Below Vienna it is proposed to complete the work of bar i ment between Mobile and Demopolis, or so much of it as may b practicable.

The cost of the annual revision of the work for the mainte the improvement is estimated at $8,000.

The immediate commercial advantage that may be expected u completion of the improvement will arise, not so much from creased amount of business done upon the river, as from the re of freight charges on the whole traffic of the Tombigbee Valley. the freight tariff shall be regulated by competition between river, maintained perennially, the advantage to the communit improved river is to be measured by the amount of business aff competition rates, and this will be all the tranportation busines Tombigbee Valley, whether handled by river or rail.

The appropriations for this improvement have been made Warrior and Tombigbee jointly and for the Tombigbee above Co as follows:

By act of March 3, 1873..
By act of March 3, 1875..
By act of August 14, 1876...
By act of June 18, 1878..
By act of March 3, 1879 ....
By act of June 14, 1880 ....
By act of March 3, 1881..
By act of August 2, 1882 ....
By act of July 5, 1884..

Total ....

Money statement.

Tombigbee River from Fulton to Vienna.

885, amount available	$3,912 01
886, amount expended during fiscal year, exclusive of liabilities nding July 1, 1885	3,788 98
1886, amount available	123 03
appropriated by act approved August 5, 1886	7,500 00
available for fiscal year ending June 30, 1887	7,623 03
nt (estimated) required for completion of existing project	6,000 00
nt that can be profitably expended in fiscal year ending June 30, 1888	6,000 00

itted in compliance with requirements of section 2 of river and
or acts of 1866 and 1867.

Tombigbee River below Vienna.

1885, amount available	$3,058 17
1886, amount expended during fiscal year, exclusive of liabilities nding July 1, 1885	2,341 47
1886, amount available	716 70
appropriated by act approved August 5, 1886	11,250 00
available for fiscal year ending June 30, 1887	11,966 70
nt (estimated) required for completion of existing project	12,888 38
nt that can be profitably expended in fiscal year ending June 30, 1888	12,888 38

itted in compliance with requirements of section 2 of river and
or acts of 1866 and 1867.

COMMERCIAL STATISTICS, TOMBIGBEE RIVER.

ales of cotton, valued at	$2,557,040
) feet timber, valued at	40,000
arrels rosin, valued at	50,000
rrels turpentine, valued at	82,500
ds stave timber, valued at	10,000
ipe staves, valued at	7,200
merchandise (up freight), valued at	2,000,000
	4,746,740

P 3.

VEMENT OF BLACK WARRIOR RIVER, ALABAMA, FROM TUSCALOOSA TO DANIEL'S CREEK.

survey of the Black Warrior River from Tuscaloosa to Sipsey as made in compliance with the provisions of the act of Congress ed March 3, 1879, in the fall of 1879.

report is contained in the Report of the Chief of Engineers, 1881, I, page 1218.

plan of improvement recommended was by the use of locks and at an estimated cost of $1,200,000, and an appropriation of $200,000 ked for to begin the work with.

river is at present navigable at high water only, and even then ordered to convene to consider and report upon the proj

The Board met at Tuscaloosa, Ala., February 10, 188 approve the method, and recommended the improveme ecuted under ordinary slackwater system, with locks an

Work was then commenced on preparation of plans an new project, which have been completed.

Should the locations, plans, and estimates under consi proved, it is proposed to apply the balance available an that may be appropriated in prosecuting the work in a those plans. The object of this improvement is especiall portation, in barges, of coal from the Warrior coal-fiel mous quantity of coal in the country through which this r its excellent quality and accessibility, prove conclusively of the early completion of this improvement, rendering the use of the General Government, the people of the G the steamers of all nations employed in the commerce of

Money statement.

July 1, 1885, amount available..

July 1, 1886, amount expended during fiscal year, exclusive of liab
outstanding July 1, 1885..

July 1, 1886, amount available..

Amount appropriated by act approved August 5, 1886.............

Amount available for fiscal year ending June 30, 1887..............

Amount (estimated) required for completion of existing project...
Amount that can be profitably expended in fiscal year ending June 3
Submitted in compliance with requirements of section 2 of rive
harbor acts of 1866 and 1867.

P 4.

Camargo, 16 miles from the mouth, and in 1852 or 1853 a steamer cended within 2 miles of City Point.

The project recommended and adopted is to obtain a high-water chan- l for four months in the year, say from December 1st to May 1st, from e mouth of the creek to City Point, a distance of 30 miles, the object ing to secure the opening of a competing route for the transportation plantation products and return supplies.

The estimated cost is $10,000. The river and harbor act of August 1882, appropriated $3,000 for this improvement, but the appropriation s not made available until March 1, 1883.

Owing to continued high water, operations were not begun until July 1883, and were suspended, on account of near exhaustion of funds, ring the following September.

The result of the work was such as to permit a steamer to make three ps to Camargo, bringing out 800 bales of cotton and 200 sacks of cot- n-seed, carrying on her trips up about 20 tons of supplies and farming plements. About 500,000 feet of lumber in logs were floated down the eam to Columbus and Aberdeen.

As no appropriation has been made since, no further work has been ne.

It is proposed to use any sum that may be appropriated in the future continuing the removal of obstructions to high-water navigation, work- g as far up in the direction of City Point as the amount available will rmit.

The benefits to commerce that would ensue from the completion of is improvement will be the opening of a water-way competing with e Mobile and Ohio Railroad, thus affording directly a more conveni- t and accessible route to the market, thereby materially decreasing ight charges on cotton and return supplies, as well as indirectly se- ring the advantages of competition.

It is estimated that about 34,000 bales of cotton now transported by il will naturally seek this route or be carried by rail at reduced rates, d that a saving of $1.50 per bale on present railroad freights would low, thus securing to the community an annual saving of $50,000 and orresponding reduction on return supplies of 80 per cent. on value of e cotton.

No commercial statistics could be obtained for Old Town Creek, but was probably the same as reported for year 1883 and 1884.

Money statement.

mount (estimated) required for completion of existing project........	$7,000 00
mount that can be profitably expended in fiscal year ending June 30, 1888	7,000 00
ubmitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

P 5.

IMPROVEMENT OF NOXUBEE RIVER, MISSISSIPPI.

The examination of this river provided for by act of Congress ap- oved March 3, 1879, was made during the month of March, 1880, and tended from Macon, Noxubee County, Mississippi, to its mouth. Report is contained in the Annual Report of the Chief of Engineers for 80.

The condition of the river when examined was such that during
seasons of the year, and at all stages of water, navigation, except
small flat-boats, was practically impossible.

Steamboats, prior to the building of the Mobile and Ohio Railro
plied this river (1859). After the construction of this railroad the bo
were withdrawn. The river banks then became overgrown with timb
much of which in time fell or slid into the river and caused the form
tion of a number of shoals and bars.

The river being virtually abandoned for the purposes of navigatio
the planters living along its banks assisted in obstructing its chann
way by building a number of fish-traps and mill-dams.

The chief obstructions to navigation consisted in the immense nu
ber of trees overhanging the river throughout its entire length.

At the time of the examination the minimum depth of the river w
found to be (at ordinary low water) from 1½ to 2 feet, and the avera
width 60 feet.

The project adopted was to afford a navigable channel for nine mont
in the year, from its mouth to the town of Macon, by the removal
overhanging timber from the banks, and such obstructions to navigati
as might be found in the river.

The estimated cost was $65,245.25.

The appropriations made for the improvement are as follows:

By act of Congress approved June 14, 1880	$12,
By act of Congress approved March 3, 1881	8,
By act of Congress passed August 2, 1882	10,
By act of Congress approved July 5, 1884	7,
Total	37,

Work on this improvement was commenced during the low-wat
season of 1880, prosecuted during the fiscal year ending June 30, 18
and June 30, 1882, and through the month of March, 1883, when, the a
propriation being about exhausted, operations were suspended.

Under the appropriation of $7,500 made by act of Congress approv
July 5, 1884, work was resumed in September, 1884, and continued un
January 12, 1885, when high water and extremely cold weather co
pelled a suspension of work.

On May 23, 1885, operations were again resumed and continued un
June 30, 1885, and through the present fiscal year to the 23d of Septe
ber, 1885, when work was suspended for want of funds.

Work during this fiscal year was commenced at a point 12½ mil
above the mouth, and the river cleared to a point 27½ miles above,
distance of 15 miles. The condition of the improvement at the end
the fiscal year is a partially-improved channel the entire distance fro
the mouth of river up to Macon, and wholly from Macon to a point
miles below, and from the mouth to a point 27½ miles above, giving
river 55½ miles wholly and 36 miles partially improved.

The amount of work done during the fiscal year is itemized as follow

Snags, logs, stumps, &c., removed	3,5
Trees trimmed	2
Overhanging limbs cut	6
Trees cut	7
Drifts removed	

Any amount that might be made available in the future would
expended in completing the improvement of the 36 miles now only pa
tially improved and in removing the snags and logs that have accum
lated in that portion wholly improved since work was suspended.

On completing the improvement as designed, the river during high-ater season will be navigable from its mouth to Macon, thus furnishig a new and cheaper transportation route for the planters along or djacent to the river for their cotton produce and supplies, the greater ortion of which is now hauled over heavy prairie roads long distances o the different stations on the Mobile and Ohio Railroad.

The work is not susceptible of permanent improvement, and will reuire an annual expenditure of at least $3,000 to maintain it in its imroved condition.

The reduction in freight charges on cotton and produce that will naturally follow the opening of this river for navigation is estimated at bout $20,000 per annum.

A corresponding decrease in the freight charges will also be felt in all ines of goods and merchandise transported, owing to the discriminaion made between through and local rates by railroads.

The shipments over the river may possibly be also increased by the imrovement furnishing the means of supplying coal to the inhabitants iving near the river, from the coal fields of the Sipsey and Warrior ivers.

Commercial statistics have been written for to Gainesville, on Noxuee River, but no answer has been received.

Money statement.

uly 1, 1885, amount available	$3,385 40
uly 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	3,222 89
uly 1, 1886, amount available	162 51
mount appropriated by act approved August 5, 1886	7,500 00
mount available for fiscal year ending June 30, 1887	7,662 51
Amount (estimated) required for completion of existing project	20,245 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	20,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

P 6.

IMPROVEMENT OF PASCAGOULA RIVER, MISSISSIPPI.

In 1873 a plan for the improvement of the river at its mouth by dredging a channel 100 feet wide and 8 feet deep at mean low water, with jetties on each side, was submitted by Lieut. James B. Quinn, Corps of Engineers, but owing to legal complications as to the ownership of what was then known as the "Noyes Canal," nothing was done under the plans and specifications then submitted.

In 1878, all fear of legal complications having been removed, an examination of the river was made under an appropriation, by act of June 18, 1878, of $10,000 for the improvement, $1,500 being allotted for the examination.

The plan adopted was the dredging of a channel 200 feet wide, 7 feet deep at mean low water, through the bar at the month of the river, and the removal of snags and overhanging trees throughout its entire length, at an estimated cost of $53,800.

At the commencement of the work there were from 3 feet to 3¼ feet on the bar at mean low water, and the river was much obstructed by snags, logs, and overhanging trees.

The following appropriations have been made:

By act of June 18, 1878 ($1,500 for examination)	$10,000
By act of March 3, 1879	14,000
By act of June 14, 1880	20,000
By act of March 3, 1881	4,000
By act of August 2, 1882	8,000
By act of July 5, 1884	3,000
Total	59,000

Dredging operations, under contract with S. N. Kimball, were commenced July 18, 1880, $8,500 of the first appropriation ($1,500 having been used on the survey), and the whole of the second ($14,000) being available for this purpose. Funds were exhausted in January, 1881, and work suspended.

Work under this contract gave a channel through the bar 1 mile in length, 75 feet wide, and 7 feet deep.

Under the appropriation of $20,000, made by act of June 14, 1880, dredging was resumed, W. G. Mitchell, of New Orleans, La., being the contractor, in March, 1881, and was concluded in March, 1882. This completed the adopted project so far as related to the improvement of the bar at the mouth, securing a channel 180 to 190 feet wide, 7½ to 8 feet deep, and enabling vessels to go up to the mills at Moss Point and load, thus saving large lighterage bills and claims for demurrage. (A shoaling is reported to have taken place in the lower end of the dredged channel during the past year.)

During the spring of 1882 a log-boat, with steam capstan, was built in Mobile, towed over to the mouth of Pascagoula River, and in June of the same year the removal of snags, logs, and overhanging trees was commenced.

At the close of the fiscal year ending June 30, 1883, the river was partially improved from the mouth to Dead Lake, a distance of 50 miles.

The improvement during the fiscal year ending June 30, 1884, consisted in reworking the portion of the river already partially improved, and resulted in securing a navigable stream for vessels drawing 6½ feet, from the light-house to half a mile above Dead Lake, 50½ miles.

During the fiscal year ending June 30, 1885, 73½ miles of the river was worked, 15 miles reworked and wholly improved, leaving 58½ miles only partially improved.

Work was finally suspended on December 23, 1884, on account of exhaustion of funds, and boats and property placed in charge of a watchman.

The result of this work up to the 30th of June, 1886, has been to secure a navigable channel from the mouth of the river to one-half mile above "Dead Lake," 50½ miles, for vessels drawing 6½ feet, and to the junction of the Leaf and Chickasaha for vessels of lighter draught during six or eight months of the year.

It is proposed to expend such funds as may be appropriated for the fiscal year ending June 30, 1887, in continuing the work of improvement as heretofore prosecuted, removing such logs, &c., from the river, from Moss Point to Dead Lake, as may have lodged during the suspension of the work, and reworking that portion between Dead Lake and the junction partially improved during last fiscal year.

Since the beginning of the work of improvement large sales of Government and State lands have been made to capitalists adjacent to the iver, and the continuance of the work will offer further inducements or investments for development of the resources of this richly-timbered ection.

This improvement will not be permanent in its character, but will reuire an annual appropriation for the maintenance of its improved conition of about $2,500.

The improvement, even in its incomplete state, has already been of reat benefit to the country depending for its trade upon the navigation f this river.

Money statement.

Pascagoula River.

uly 1, 1885, amount available	$569 16
uly 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	455 79
uly 1, 1886, amount available	113 37
mount appropriated by act approved August 5, 1886	25,000 00
mount available for fiscal year ending June 30, 1887	25,113 00
Amount (estimated) required for preservation of improvement	2,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	2,500 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

tatistical statement of commerce of the port of Pascagoula, Miss., for fiscal year ending June 30, 1886.

Vessels.	Entrances.		Clearances.	
	No.	Tons.	No.	Tons.
oreign	58	35,719	60	36,825
oastwise	67	14,609	81	14,716
merican	29	5,918	29	5,265
Total	154	56,246	170	56,806

ees	$1,185 51
uties on imports	7 20
onnage dues	1,648 71
ospital collections	105 00
iscellaneous	17 23
Total collections	2,963 65
xports to foreign ports	$386,084 33
mports of foreign goods	36 00

P 7.

IMPROVEMENT OF HARBOR AT BILOXI BAY, MISSISSIPPI.

The examination of this roadstead, provided for by the third section of river and harbor act of March 3, 1881, was made during the months of August and September, 1881. The report is contained in the Annual Report of Chief of Engineers, 1882, Appendix K 27.

The examination showed that between the roadstead and the Back Bay are situated a series of mud flats, called "Deer Island Flats," distant about 1¼ miles east of Biloxi, having a present depth of 4 feet.

The improvement understood to be desired was to secure through these flats a channel 8 feet deep. The estimated cost of this work by dredging was $35,000. An appropriation of $5,000 for the improvement of this roadstead was made by act of Congress passed August 2, 1882.

No project was submitted, the amount appropriated being deemed insufficient for an economical prosecution of the work. Authority was therefore obtained under date of September 25, 1882, to defer all action until a further appropriation was made.

The river and harbor act of July 5, 1884, directed that the balance of the money heretofore appropriated for the roadstead, now on hand, be applied to the deepening of the channel from Mississippi Sound to the wharves of Biloxi.

The examination of this locality was made during the months of August and September, 1881, and report is contained in Annual Report Chief of Engineers, 1882, Appendix K 27.

The improvement understood to be desired is the deepening of the channel from Mississippi Sound to the wharves at Biloxi, from 4½ feet, the least depth at present, to 8 feet at mean low water.

The improvement can be accomplished by dredging, and a channel 150 feet wide and 8 feet deep at mean low water obtained for about $55,000, but it is not believed that it would be permanent.

Authority was obtained, under date August 27, 1884, to hold the appropriation until a further one is made sufficient to permit an economical prosecution of the improvement contemplated.

No work has been attempted, nor is any proposed, until further appropriations are made.

Such sum as Congress may appropriate for expenditure during the fiscal year ending June 30, 1887, together with amount now on hand, will be applied to deepening the channel as proposed from 4½ to 8 feet.

The increase of commerce likely to ensue from the completion of this improvement would be impossible to estimate at present. Commercial statistics have been requested from the collector of customs at Biloxi, but have not been furnished.

Money statement.

July 1, 1885, amount available	$4,988 55
July 1, 1886, amount available	4,988 55
Amount appropriated by act approved August 5, 1886	12,500 00
Amount available for fiscal year ending June 30, 1887	17,488 55
Amount (estimated) required for completion of existing project	37,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	37,500 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

P 8.

IMPROVEMENT OF HORN ISLAND PASS, MISSISSIPPI.

The examination of this locality was made during the months of August, and September, 1881, and report is contained in Annual Report Chief of Engineers, 1882, Appendix K 28.

This pass is the nearest outlet to sea for all vessels loading at Pascagoula, Miss., and the object desired is to obtain 21 to 22 feet depth through this pass at mean low water, thus enabling vessels drawing more than 17 to 18 feet to complete their loads near Pascagoula, saving the cost of a long, expensive, and dangerous tow, 25 miles to Ship Island, Mississippi, where they are now obliged to load.

The proposed improvement of the pass would allow them to load within 9 miles of their principal source of supply.

The present depth of the pass is over 16½ feet at mean low water (the exact depth is unknown as it is deepening constantly and no recent soundings have been made).

The improvement, if required, can be made by dredging, and the estimated cost for a channel 100 feet wide, 21 feet deep, was $43,000 at the time of the examination.

An appropriation of $5,000 was made by the river and harbor act of July 5, 1884, for the improvement of this pass.

No project was adopted as the amount was deemed inadequate to an economical prosecution of the work. Authority was therefore obtained to hold this appropriation until one sufficient for economical work has been made.

Nothing has therefore been done during the present fiscal year, nor will anything be attempted until further appropriations are made.

It is probable no improvement will be needed at this point, owing to the increase in depth from natural causes.

Money statement.

July 1, 1885, amount available	$5,000 00
July 1, 1886, amount available	5,000 00

Statement of vessels entered and cleared through Horn Island Pass during fiscal year ending June 30, 1886.

Nationality.	Entered.	Cleared.
Foreign	58	60
American	29	29
Total	87	89

P 9.

IMPROVEMENT OF PEARL RIVER, MISSISSIPPI, BELOW JACKSON.

The original project for improving this part of the river was adopted in 1880, the object being to obtain a navigable channel 5 feet deep, at low water, from Jackson down to the mouth by the removal of snags, stumps, roots, and sunken trees, and the clearing of the banks of overhanging trees, at an estimated cost of $95,940, based upon the report of a survey made under direction of Capt. C. W. Howell, Corps of Engineers, by Mr. H. C. Collins, the assistant engineer in charge, in March and April, 1879, at a stage 10 feet above low water.

Congress, by act approved July 5, 1884, included the bar at the mouth of the river, the rough estimate of the cost of improvement of which is $20,000.

The following appropriations have been made:

By act June 14, 1880	$30,000
By act March 3, 1881	25,000
By act August 2, 1882	15,000
By act July 5, 1884	10,000
Total	80,000

After due advertisement a contract was entered into October 7, 1880 with S. N. Kimball for the improvement of 195 miles of the river from Jackson down.

Owing to high water the contractor was unable to complete his work within the time specified, January 1, 1882, and an application for extension of time to January 1, 1883, was approved.

Under the appropriation of $25,000 made by act of March 3, 1881, a project for the expenditure of this amount was submitted and approved.

After due advertisement a contract was entered into with G. A. Meyers for the improvement of 100 miles more of the river, commencing at a point 195 miles below Jackson, the end of Kimball's work.

On July 27, 1882, the work was reported finished, but an inspection showed that it was not in accordance with specifications, and the contractor resumed work. August 23, 1882, the work was accepted.

Two hundred and ninety-five miles of this part of the river were somewhat improved, and there remained from 15 to 20 miles of bad river near the mouth upon which no work had been done.

Under the appropriation of $15,000, made by act of August 2, 1882, the amount was to be expended under the supervision of the United States Engineer Office by hired labor.

In November, 1883, the work was for various reasons suspended. A watchman was placed on the plant to take care of the property.

The work accomplished by hired labor was the closure of twelve run-out bayous by levees and piling, the cutting of 120 snags, and the girdling of 700 trees on the banks.

Under the appropriation of $10,000 made by act of July 5, 1884, the work on the improvement of this part of the river was continued by hired labor till September, 1884. In accordance with instructions from the Chief of Engineers, United States Army, dated Washington, D. C., July 8, 1884, this work was transferred by Maj. Amos Stickney, Corps of Engineers, United States Army, to Maj. A. N. Damrell, Corps of Engineers, United States Army.

The sum of $5,154.83 was transferred by Major Stickney.

Ten thousand dollars appropriated by act of Congress approved July 5, 1884, was also available, making a total on hand at the transfer of $15,154.83.

From September to December 1, 1884, operations on this part of the river were suspended and a watchman was employed.

Work was again commenced December 1, 1884, and continued whenever the stage of water permitted working to advantage, June 30, 1885, at which time the condition of the improvement was as follows:

Two hundred and ninety-five miles of this river, from Jackson down to Poitevant's Bluff, had been partially improved by contract; 15 miles of this distance, from the head of West Pearl down to lower end of Homes Bayou, had been reworked by hired labor, but the improvement had not been completed.

During the fiscal year ending June 30, 1886, operations were continued from June 30, 1885, to March, 1886. The work consisted in widening and deepening a cut-off three-fourths of a mile above the head of West Pearl, removing snags, overhanging timber, and log-jams, and partially closing 8 sloughs and run-out bayous on that section of the river from the head of West Pearl to the mouth of Homes Bayou, detailed as follows:

	Number.
Stumps removed	717
Roots removed	1,271
Snags removed	1,767
Sunken logs removed	1,130
Sunken trees removed	846
Cypress knees removed	45
Overhanging trees removed	8,382
Cubic yards of clay and sand removed	2,752
Running yards of cane removed	7,838

The large drift of logs and trees that was placed and secured across the head of West Pearl during the last fiscal year was increased, willows were planted, and several hundred large trees were felled into the river below the drift, so as to lessen the current and cause sand-bars to form.

March 30, 1886, operations on this part of the river were suspended and the derrick, snag, and quarter boats were carried up the river to Wakiah Bluff and laid up. A watchman was placed in charge to take care of the property.

The condition of this part of the river has been greatly improved by the work done, particularly Homes Bayou, which before the improvement had always been considered the worst part of the whole river, steamboats taking from six to eight days to pass through, while since the improvement they go through in four hours. The river below Homes Bayou to the mouth has not been improved.

The condition of the cut-off near the head of West Pearl has greatly changed and improved during the year. It is widening and deepening. The only obstacle that seems to prevent steamboats from using it during high water is the very strong current, which boats are unable to stem. It can be reasonably expected, however, that when, either by washing and scouring or by additional work, this cut-off has attained a minimum width of, say, 150 feet, and the same depth as found above or below, the current will not be any stronger than is found in other parts of the river.

A number of sand-bars and shoals that had formed within the last six years below the cut-off are now deepening on account of the increased volume of water and current due to the opening of the cut-off above. Nearly all the jetties and dams constructed and piles driven heretofore across a number of run-out bayous, between the head of West Pearl, East Pearl, and Homes Bayou, have been damaged.

The condition of the river above the cut-off as far as Jackson, Miss., is about the same as when left by the contractors, and can be navigated only safely on a 6 or 7 foot rise.

The benefits derived by the improvement of the river effected up to June 30, 1886, are as follows:

Greater security to navigation between New Orleans, La., and Jackson, Miss., and reduced freights on merchandise and produce.

A large proportion of the cotton, merchandise, &c., were before the improvement hauled from Georgetown, Columbia, Monticello, and other towns and settlements located on the river to the nearest railroad station on the Illinois Central and Northeastern railroads, a distance of from 20 to 40 miles.

Freight on a bale of cotton shipped in this way to New Orleans, La., was $4.80; a barrel of flour shipped in this way from New Orleans to Columbia or Monticello, $2.

Freight on a bale of cotton shipped down the river by boats, delivered at New Orleans, La., costs now $1.50; a barrel of flour, 60 cents; other freights in proportion.

This shows there is a very large reduction and saving in freights by river competition by the improvement of the river.

It is proposed to apply the amount appropriated for the next year to the deepening and widening of the cut-off situated near the head of West Pearl River, to the closing effectually of Fan Slough, Parker's Bayou, Twin Bayou, and Little Homes Bayou, and the improvement of the river between Homes Bayou and the mouth and that part of the river above the cut-off near the head of West Pearl, towards Jackson, Miss., so as to obtain a 2-foot channel at low water as far up as the amount available will permit.

In addition to the improvement of the river proper, the increased lumber trade of the mills situated on the river, particularly that of Messrs. Poitevant & Favre, at Pearlington, Miss., located about 12 miles above the mouth of East Pearl River, demands the deepening of the bar at the mouth by dredging.

Vessels of 7 feet draught of water can be loaded at the mills on the river, but the lumber for vessels of heavier draught, of which there are large number loaded at the mills, must now be lightered and towed over the bar, which not only causes great delay, but heavy expenses.

It is desired by mill-owners and those interested in the lumber business on the river to obtain a 12-foot channel over the bar. After vessels cross the bar there is sufficient water up to the mills to load down to 12 feet.

The estimated cost of dredging a channel 12 feet deep at mean low tide over the bar at the mouth of East Pearl River is $20,000.

Owing to the caving in of banks after freshets, as also to the shifting of the channel, the improvements so far made and contemplated will not be permanent.

An annual appropriation of $5,000 would be sufficient to maintain the river in the condition contemplated by the plan of improvement.

The amount asked for this work is in excess of the original estimate. The reasons are as follows:

First. The survey of the river upon which the original estimate was based was made at a stage 10 feet above low water. The result was decided underestimate of the amount of work and cost.

Second. A large portion of the work was done by contract, and done by the contractors as to require reworking.

Third. The obstructions forming each year of snags, sunken logs, and overhanging trees requiring removal were not included in the original estimate, but are included up to date in the proposed modification of existing project. The extent of the anticipated excess is $50,000.

Money statement.

July 1, 1885, amount available	$8,380
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	8,378
July 1, 1886, amount available	1
Amount appropriated by act approved August 5, 1886	12,625
Amount available for fiscal year ending June 30, 1887	12,626
Amount (estimated) required for completion of proposed modification of existing project	70,000
Amount that can be profitably expended in fiscal year ending June 30, 1888	50,000
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

Number of vessels entered, cleared, and loaded, Pearl River, Mississippi.

Character of vessels.	American.	Foreign.	Tonnage.
ips	1	......	600
rks	......	3	1,400
igs	2	......	600
hooners	54	......	9,400
Total	57	3	12,000

Number of vessels employed lightering lumber from Pearl River, Mississippi.

Character of vessels.	No.	Tons.
eamers	6	250
hooners	18	720
rges	3	240
Total	27	1,210

Statement of lumber shipped from Pearl River.

Direction.	Superficial feet.
ipped to exportation	20,287,967
ipped to dealers	24,050,000
ipped to foreign and coastwise	9,226,829
Total	53,564,796

Imports via Pearl River.

Articles.	Tons.
ahogany and cedar	1,500
ye-woods, &c	550
emp	250
[illegible]	400
Total	2,700

Statement of vessels employed on Pearl River below Jackson.

Character of vessels.	Number.	Tonnage.
Steamboats	6	590

Statement of staple articles transported on Pearl River below Jackson to and from N Orleans, La., and to saw-mills near the mouth.

Articles.	Numbe
DOWN-STREAM.	
Cotton .... bales..	2,
Rice .... barrels..	1,
Rosin and turpentine .... do ..	2,
Staves .... number..	8,
Fire-wood .... cords..	2,
Saw-logs .... number..	12
UP-STREAM.	
Fertilizers .... tons..	5,
Grain .... do..	
Machinery, &c .... do..	
General merchandise .... do...	24,

Statement of staple articles transported on Pearl River below Jackson for preceding ye 1884–1885.

Articles.	Numbe
DOWN-STREAM.	
Cotton .... bales..	3,
Rice .... barrels..	
Staves .... number..	10,
Fire-wood .... cords..	2,
Saw-logs .... number..	20
Square timber .... cubic feet..	50,
UP-STREAM.	
Fertilizers .... tons..	
Grain .... do....	
Machinery, &c .... do....	
General merchandise .... do....	
Total	1,

P 10.

IMPROVEMENT OF PEARL RIVER, MISSISSIPPI, FROM JACKSON TO CA THAGE.

An examination of this part of the river was made under the dire tion of Capt. C. W. Howell, Corps of Engineers, United States Army in 1879.

The original project for the improvement of this part of the river con sisted in the removal of snags, logs, and overhanging trees, and to af ford a channel of navigation 5 feet deep at a low stage of the river fro Jackson to Carthage, a distance of 105 miles, at an estimated cost $21,000.

This amount is not sufficient to clear the river of obstructions so as give safe navigation during a low stage of water.

The original estimate should be increased $29,000.

The reason for the increase in the expenditure over the original estimate is that the examination was made at a high stage of water, whe many of the obstructions could not be seen, and the estimates were base on the report of the examination.

The following appropriations have been made:

By act March 3, 1879	$6,00
By act June 14, 1880	7,50
By act March 3, 1881	2,50
By act August 2, 1882	2,50
Total	18,50

Under the appropriation of $6,000 made by act of March 3, 1879, a contract was entered into with J. S. Hamilton, November 20, 1879, for he improvement of this part of the river.

Under the appropriation of $7,500, made by act of June 14, 1880, anther contract was made with J. S. Hamilton to continue the work.

Under the appropriation of $2,500, made by act of March 3, 1881, afer due advertisements no bids were received, and the amount was llowed to stand awaiting further appropriations sufficient to warrant commencement of work.

Uunder the appropriation of $2,500 made by act of August 2, 1882, a project was submitted August 17, 1882, to continue the work by hired abor, which was approved.

The work under the Hamilton contract did not prove satisfactory, and the contracts were annulled September 22, 1882.

On July 8, 1884, the work was in accordance with instructions from he office of the Chief of Engineers, United States Army, transferred by Maj. Amos Stickney, Corps of Engineers, United States Army, to Maj. A. N. Damrell, Corps of Engineers, United States Army, and the improvement was carried continuously down-stream to a point 12 miles below McFadden's Ferry, at Carthage. In the balance of the river down to Jackson, 93 miles, only the worst and most dangerous places were partly improved. The entire distance requires working over again.

In January, 1885, the appropriation being exhausted, the derrick and quarter-boats were carried down-stream to Wakiah Bluff, the boats and machinery overhauled, and the boats laid up to be used on the improvement of the river below Jackson.

Before the improvement, even during high water, steamers could not make more than two trips a month between Jackson and Carthage, while since the improvement boats make four and five trips a month.

The condition of the river on June 30, 1886, was as follows: 12 miles rom Carthage down boats of 3 feet draught of water can navigate with comparative safety at a stage of river 4 feet above ordinary low water.

In the other part of the river, down to Jackson, boats can navigate on 6-foot rise above ordinary low water.

The improvement of this part of the river is not permanent, but will have to be worked over again from time to time, owing to the caving in of banks and the shifting of the channel.

No work was done on this part of the river during the fiscal year ending June 30, 1886.

An annual expenditure of $2,400 would maintain the river in the condition contemplated by the plan of improvement.

As there was only one steamer, the O. R. Singleton, navigating between Jackson and Edinburg, making Carthage only a way landing, he commercial statistics for this part of the river are the same as for hat portion between Edinburg and Carthage. They have been asked for, and when received will be completed and forwarded as a supplementary report.

Money statement.

July 1, 1885, amount available	$52 40
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	52 40
Amount appropriated by act approved August 5, 1886	2,250 00
Amount available for fiscal year ending June 30, 1887	2,250 00
Amount (estimated) required for completion of existing project	29,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	10,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

P 11.

IMPROVEMENT OF PEARL RIVER, MISSISSIPPI, BETWEEN EDINBURG AND CARTHAGE.

A survey of this part of Pearl River was made under direction of Maj. Amos Stickney, Corps of Engineers, United States Army, during the month of November, 1883.

The original project for the improvement of this part of the river is to afford a high-water channel from Edinburg to Carthage, a distance of 24¾ miles, for six or eight months of the year, at an estimated cost of $13,464.

There is no navigable channel in the greater portion of this part of the river during low water. Although high banks are found on both sides of the river, yet the river is so obstructed by fallen trees, snags, roots, logs, sand and mud bars, and overhanging trees, that navigation by the steamer O. R. Singleton, built for this trade in 1883, was only possible during very high water.

Under an allotment of $2,500, made by act of July 5, 1884, work on this part of the river was commenced at Edinburg on the 17th of November, 1884, and continued until the 23d of January, 1885, when the river becoming too high for working to advantage, operations were suspended.

Nineteen miles of this part of the river, from Edinburg down, were partially improved. On the 3d of September, 1885, operations were resumed. Commencing 19 miles below Edinburg, the work was carried down to Carthage, 5¾ miles. Such stumps, roots, logs, and trees as were found most in the way were removed by cutting and blasting. On September 30, 1885, the appropriation being nearly exhausted, operations were suspended and the plant and property stored at Edinburg.

The method of improvement is the removal of obstructions from the channel and clearing of the banks of overhanging trees by hired labor and purchase of material.

The amount of work accomplished on this part of the river during the fiscal year ending June 30, 1886, is as follows:

Number of stumps blasted and removed	[illegible]
Number of sunken logs and trees cut	[illegible]
Number of overhanging trees removed	[illegible]

A large amount of drift and brush were also removed.

Owing to the continual washing of banks, causing trees to fall in, the improvement made will not be permanent. It is estimated that an annual expenditure of $500 will maintain the river in the condition contemplated by the plan of improvement.

Considerable benefit was derived from the work so far done, as shown by the fact that before the improvement the time consumed by the steamer ascending the river from Carthage to Edinburg averaged six days, while after the partial improvement the steamer made several trips in twelve hours.

The condition of the improvement on June 30, 1886, was such as to allow boats of 3½ feet draught of water to navigate the river between Edinburg and Carthage with comparative safety on a rise of 8 feet above low water.

Before the improvement, most of the produce and merchandise had to be hauled by wagons between Edinburg and railroad stations a distance of from 40 to 60 miles.

The reduction and saving in railroad freights by river competition due to improvement is considerable, as shown by the following exhibit: Freight on a barrel of flour from Mobile, Meridian, or New Orleans, delivered at Edinburg, was, before the improvement, $2; now it is 60 cents. The saving in freight on a ton of fertilizer is $5, on a bale of cotton $4. It is estimated that the aggregate saving in freights annually to the farming interests of the county adjoining the river, due to the improvement, will not fall short of $30,000.

Only one boat, the steamer O. R. Singleton, has been employed on this part of the river during the fiscal year. Her dimensions are, length, 95 feet; tonnage, 110; draught of water, 4½ feet.

Money statement.

July 1, 1885, amount available	$389 61
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	389 06
July 1, 1886, amount available	55
Amount appropriated by act approved August 5, 1886	2,250 00
Amount available for fiscal year ending June 30, 1887	2,250 55
Amount (estimated) required for completion of existing project	10,964 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	10,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

Improving Pearl River, Mississippi, between Edinburg and Carthage, during the fiscal year ending June 30, 1886.

Articles.		Number.
UP-STREAM.		
Fertilizers	tons	140
Machinery, &c	do	200
General merchandise	do	200
Grain	do	120
DOWN-STREAM.		
Cotton	bales	750
Wool	do	90
Staves		7,000
Poultry eggs, &c	dozens	1,330
Saw-logs		8,500
Firewood	cords	300

P 12.

PRELIMINARY EXAMINATION OF PASCAGOULA RIVER, MISSISSIPPI, FROM THE MILLS AT MOSS POINT DOWN TO THE ANCHORAGE IN THE BAY, WITH A VIEW TO SECURING A UNIFORM DEPTH OF TWELVE FEET OF WATER.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., October 17, 1884.

GENERAL: I have the honor of submitting the following report upon the preliminary examination of "Pascagoula River, from the mills at Moss Point down to the anchorage in the bay, with a view to securing a uniform depth of 12 feet," ordered by circular letter of July 31, 1884.

The distance from Moss Point to the 12 foot curve in Mississippi Sound is about 11 miles.

There is generally over 12 feet of water in the Pascagoula River, but there are at least two bars between Moss Point and the New Orleans and Mobile Railroad Bridge, about 500 feet in length, each with a minimum depth of only 8 feet.

There is a channel through the bar at the mouth of the river 180 feet wide and nearly 8 feet deep, obtained by dredging from 1880 to 1882.

In my opinion this river is worthy of improvement, for the following reasons:

The cost of the work would not probably exceed $200,000.

The commerce to be benefited is large, as will be seen from the following statement:

Vessels cleared for foreign countries from June 30, 1883, to June 30, 1884....	13[illegible]
Vessels cleared, coastwise........	[illegible]
Total........	17[illegible]
Tonnage of foreign clearances........	68,4[illegible]
Tonnage of coastwise........	14,61[illegible]
Total........	83,04[illegible]

Value of exports from June 30, 1883, *to June* 30, 1884.

Articles.	Quantity.	Value.
Foreign:		
Lumber........superficial feet..	38,635,542	$516,916 [illegible]
Timber........cubic feet..	1,997,848	87,052 [illegible]
Total........	40,633,390	603,968 [illegible]
Coastwise:		
Lumber........superficial feet..	6,741,208	53,929 06
Total exports........	....	657,897 06

In 1880, before the improvement above mentioned was accomplished, the commerce was as follows:

Direction.	Vessels entered.	Vessels cleared.	Tonnage (entrances).	Tonnage (clearances).
Foreign........	61	64	23,831	24,5[illegible]
Coastwise........	23	37	5,301	8,4[illegible]
Aggregate........	84	101	29,132	[illegible]

Thus showing a large increase, and it is believed that the increase in the depth of the channel to 12 feet will result in a still larger increase.

The estimated cost of the survey is $2,400.

Very respectfully, your obedient servant,

A. N. DAMRELL,
Major, Engineers.

The CHIEF OF ENGINEERS, U. S. A.

SURVEY OF PASCAGOULA RIVER, MISSISSIPPI, FROM THE MILLS AT MOSS POINT DOWN TO THE ANCHORAGE IN THE BAY, WITH A VIEW TO SECURING A UNIFORM DEPTH OF TWELVE FEET OF WATER.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., January 30, 1886.

SIR: I have the honor of transmitting the report of Mr. R. Rauchenstein, assistant engineer, upon the survey of the Pascagoula River, Mississippi, from Moss Point down to the anchorage in the bay, with a view to securing a uniform depth of 12 feet of water.

The places between the limits specified having less than the required depth are Chammier Shoals, 2 miles below Moss Point, about 3,200 feet long, with a minimum depth of 9 feet; two small shoals above and two small shoals below the railroad bridge at Scranton, 1½ miles above its mouth, with a minimum depth of 7½ feet on them, and the bar at the mouth, with a minimum depth of 7½ feet at the time of the survey, and 4 miles long from the 12-foot curve inside to the 12-foot curve in the anchorage.

A channel of navigable width and minimum depth of 12 feet from Moss Point to the anchorage in the bay, a distance of about 11½ miles, can be obtained by dredging, which, while it would not be permanent, could be maintained at small expense.

The estimated cost of the work is $78,100. The object of the improvement is saving the lighterage in allowing vessels to proceed to the mills for full or partial loads.

The present commerce to be benefited is shown by the following statement:

A considerable increase would probably follow upon the completion of the proposed improvement, but no reliable estimate can be made as to the amount of the increase.

The following tracings are forwarded:

General map of survey, detail sheets Nos. 1, 2, 3, 4, which, together with report of Mr. Rauchenstein, above mentioned, will show details of work and estimate.

Very respectfully, your obedient servant,

A. N. DAMRELL,
Major, Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. R. RAUCHENSTEIN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., January 20, 1886.

SIR: In pursuance of your instructions of December 12, 1884, I have the honor to submit herewith my report on the results of the survey of Pascagoula River, Mississippi, made for the purpose of estimating the cost of opening a 12-foot channel from the "mills at Moss Point down to the anchorage in the bay," authorized by act of Congress approved July 5, 1884.

The accompanying tracings of a general map of that section of Pascagoula River and Mississippi Sound embraced in the above survey, and detailed sheets of different sections of the same, will fully explain the topography, as well as hydrography, deemed necessary for the purpose of making the desired estimate. All soundings are reduced to mean low-water gauge used during dredging operations, 1882, 1883, which seem to agree with the one established by United States Coast Survey.

The Pascagoula River, from the mouth of Big Dog River (on which latter stream all the saw mills are located) to the sound, at ordinary stages of water, is a tidal river; the ordinary rise and fall of the tide is 1.3 feet. The current during flood tide at no time exceeded 1¼ miles, while during ebb tides, at times, exceeded 4 miles. On account of unfavorable weather no accurate current observations could be made. I am satisfied, however, that with a normal width of river a 12-foot channel once opened, although not permanent, may be maintained at a very small expense.

Considering the present condition of the channel, the soundings show that, starting from the mouth of Big Dog River, a short distance above which some of the Moss Point saw-mills are situated, the channel of the Pascagoula River has a sufficient width and depth for a distance of about 2 miles, to Chammier Shoals, where the river makes a bend to the left, changing its westerly to a southeasterly course, and its width at this bend increases from 900 feet above to about 1,500 feet, and is divided by a small island, near the west bank in the elbow of the bend, into two channels. The one on the east side, being about 1,000 feet wide, forms a shoal about 3,200 feet lo through which there is a channel, now used by the boats, with a minimum depth o feet.

The channel on the west side of the island, about 500 feet wide, although deep behind and below the island, is practically closed at and immediately above the h of the island, caused by an accumulation of sunken logs, timber, &c. The length the shoal along the west bank, from the 12-foot curve above to the 12-foot curve behind the island, is 2,100 feet.

Two projects are submitted for the opening of a 12-foot channel through thi shoal:

(1) For opening west channel. To dredge a 100-foot channel along the weste shore and connect the deep water above with the 12-foot curve behind the island, depositing the material along the west bank for its protection, and contract the enlarg cross-section of the river at the head of the island by a submerged jetty extendi from the eastern shore about 500 feet into the river.

(2) For opening east channel. To close the channel on the west side of the isla by a pile dam from near its upper end to the western shore, and deepening the cha nel on the east side of the island by dredging, should the increase of the velocity the current produced by the closing of the west channel prove insufficient to deepe the present east channel by scouring.

My estimate is based upon the adoption of the first project, of opening the wes channel, and will fully cover the cost of the second, or east channel, should it b adopted.

Between this shoal and the mouth of the river, a distance of 5.11 miles, we encounter four small shoals, two above and two below the railroad bridge which spa the river at Scranton, about 1¼ miles above its mouth, offering, however, with its tw 80-foot draw openings, no impediment to the navigation of the river. A channel wi have to be dredged through the four shoals mentioned, the cost of which is include in the estimate.

At the mouth of the river, opposite the town of East Pascagoula, on the east and a short distance to the northward of the light-house on the west, we strike the bar, th dredging through which for a 12-foot channel extends continuously to the 12-foo curve in the anchorage, a distance of 4 miles.

During the years 1882 and 1883 a cut with 7.5 feet depth of water and about 180 fee wide was dredged through the crest of the bar, sweeping from a north and sout course in the river, in a continuous curve, to an east-southeast course at its souther end, and in locating the new or 12-foot channel to the anchorage, advantage was take as much as possible, without making unnecessary curves, of this former cut, as th general map or detail sheet will show.

The direction of this cut is southeast, chosen to correspond with the direction o the current of the ebb tide at the time of its location, the prevailing wind bei north; the estimate, however, will cover any slight change that may have to be ma upon more extended current observations, which bad weather prevented me fro making.

The estimate of cost of this improvement is made for 100 feet width in bottom o cut, with slopes of 1 in 3 and 1 in 2, according to nature of material, which consi on the outer slope of the bar of soft bluish mud, mixed with sand, while on the inn slope and through the shoals in the river this material is covered with a layer of sa more or less compact from 1 to 2.5 feet thick.

The above-described work comprises all the dredging required for a 12-foot chann from the lower mills at Moss Point to 12-foot water in anchorage in the Mississip Sound for the improvement of Pascagoula River only.

In order to reach all the saw-mills at Moss Point, on Big Dog River, with 12 feet o water, a small shoal on the north side of an island, a short distance above the co fluence of the two rivers, will have to be dredged, and as the amount required to d this work is small, I have included it in the estimate.

I have estimated the dredging at three different prices, viz, at the bar and lowe portion in the river, where a large amount of work has to be done, 15 cents per cubi yard, the average distance to dumping-ground not exceeding 3 miles. At Chammie Shoals, where the dredged material has to be deposited on west bank of channel, cos estimated is 60 cents per cubic yard, and at island in Dog River, where only a smal amount of work is required, the price is 25 cents per cubic yard, distance to dum ing-ground being about 3 miles.

ESTIMATE OF COST OF SECURING A 12-FOOT CHANNEL FROM THE MILLS AT MO POINT TO THE ANCHORAGE IN THE BAY.

Excavation through the bar at the mouth of the river, 361,280 cubic yards, at 15 cents..........	$54,19
Excavation through the four shoals in lower part of river, 48,820 cubic yards, at 15 cents..........	7,3

avation at Chammier Shoals for opening west channel, 29,400 cubic yards, t 60 cents	$17,640
feet submerged jetty, at $4.50	2,250
avation at island in Dog River, 5,660 cubic yards, at 25 cents	1,415
erintendence and contingencies, 10 per cent	8,282
Total	91,100

hould project No. 2 be adopted for deepening the east channel and closing the one
t of the island at Chammier Shoal, a deduction of at least $13,000 can be made
n the above estimate.

s to the benefit to be derived by the saw-mill interest at Moss Point from the pro-
ed improvement, it would no doubt greatly increase the coastwise lumber trade,
robably all vessels engaged in that trade could ascend the river and load at the
ls and thus save lighterage, but as to the extent of the increase in this trade and
actual benefit to be derived therefrom I am unable to form an opinion, as no re-
le statistics could be obtained in regard to it.

his contemplated work is located in Jackson County, Mississippi, collection dis-
t of Shieldsboro', with a deputy collector at Scranton, Miss., from whom the fol-
ing statistics in regard to the lumber and timber trade in his district have been
ained.

Very respectfully, your obedient servant,

R. RAUCHENSTEIN,
Assistant Engineer.

laj. A. N. DAMRELL,
Corps of Engineers, U. S. A.

Comparative custom-house returns, Pascagoula, Miss.

Flag.	Entrances.				Clearances.			
	1884.	1885.	Total No.	Total tons.	1884	1885	Total No.	Total tons.
erican	27	35	62	9,166	13	14	27	4,397
eign	20	32	52	30,894	23	37	60	33,149
Total	......	......	114	40,060	......	......	87	37,546

t of clearances and statement of lumber shipments from Pascagoula, Miss., June 30, 1885.

sels:	
Number	178
Tonnage	8,858
aber:	
Superficial feet	39,274,920
Value	$516,914
ber:	
Cubic feet	2,197,607
Value	$86,907
tom-house receipts for miscellaneous cargoes	$14,057

Approximate tonnnge on Pascagoula River.

Character of vessels.	No.	Tonnage.
m tugs	9	250
ooners, large	15	1,500
ooners, small	40	800
ges	18	1,260

P 13.

PRELIMINARY EXAMINATION OF WACISSA RIVER, FLORIDA.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., October 21, 1884

SIR: I have the honor of submitting the following report upon th preliminary examination of Wacissa River, Florida, ordered by circul letter dated July 31, 1884.

In my opinion the river is worthy of improvement, for the followin reasons:

The cost of the improvement desired will not exceed $17,000.

There is no present commerce worth mentioning, but it is believ that there would be more than sufficient developed by the improvem to warrant the expenditure of the sum required, as it would furnish water route for the transportation to a market of large quantities pine, cypress, and other fine timber, cattle, and grain.

The river is very straight, and runs nearly due south from the fertil hill-country of Jefferson County into the Aucilla, which empties int the Gulf of Mexico, near Saint Mark's.

The work required to effect the improvement is the construction of short dam and the completion of a canal begun by a private compa formed in 1856. The object of the dam is to cut off the water flowin into the Aucilla above the obstruction caused by the lower natur bridge, and the canal to carry the water in a navigable channel int the same river below the obstruction.

No survey will be required, as sufficient information was obtained the examination for the preparation of a project and estimate of cost the improvement.

Respectfully submitted.

A. N. DAMRELL,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

EXAMINATION OF WACISSA RIVER, FLORIDA.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., January 30, 1886

SIR: I have the honor of transmitting the report of Mr. R. Rauche stein, assistant engineer, upon the examination of Wacissa River, Flo ida.

This river is a tributary of the Aucilla. It rises in Jefferson County, Florida, and flows south in a very direct line through a dense swamp, forming, with the latter, a navigable water-route from near the sourc to the Gulf of Mexico, about 20½ miles long.

The obstructions to navigation are snags, overhanging trees, aquati plants, and small shoals.

The improvement of the river so as to give a minimum width of 3 feet and a sufficient depth for boats drawing 2½ feet at ordinary lo water would require the removal of the snags, overhanging trees and brush, and aquatic plants, the excavation of rocks and earth at th shoals, and the construction of a dam for training a portion of the wate now emptying into the Aucilla above the lower natural bridge (a complete obstruction) on the latter into the same river below it, and a small amount of levee work.

The estimated cost of the improvement is $17,000.

About 2½ miles of the water-route above referred to is a canal, which was opened, by a company formed about 1856, with State aid. About 1880 a new company was formed, under the name of the "Aucilla and Wacissa Navigation Company," which had an examination of the river made, but have done no other work.

The object of the improvement is to provide a short and cheap water route for the products of the country near the river, which consists now of large amounts of very fine timber, principally pine and cypress, and cattle, in place of the present long and expensive route of about 14 miles over rough hilly roads to the nearest railroad, by the latter to the nearest market.

With an improved river it is possible a large amount of grain would be added to the products that would be transported on it.

The commerce on the river is, at present, very small, hardly worth mentioning. No reliable estimate can be made of the amount that would be developed by the improvement, and although it would probably be sufficient to warrant the comparatively small amount needed, it is still evident that this belongs to that class of works that might well be deferred until those of more importance are completed. Tracings are forwarded as follows:

General index map and sheet showing location of dam, which, together with Mr. Rauchenstein's report, will furnish details of examination and estimate.

Very respectfully, your obedient servant,

A. N. DAMRELL,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. R. RAUCHENSTEIN, ASSISTANT ENGINEER.

MOBILE, ALA., *October* 20, 1884.

SIR: In compliance with instructions contained in your letter dated September 29, 1884, I have the honor to submit the following report upon the examination of Wacissa River, Florida.

The Wacissa River is located in the southern portion of Jefferson County, Florida, between the Saint Mark's and Aucilla rivers, and is a tributary of the latter, emptying its waters into this river about 6 miles above its mouth.

The Wacissa River is formed by a collection of a number of large springs, which rise in the flat pine woodland at the foot of the fertile hill country of Jefferson County. In addition to the springs two small branches, the Mill Branch, from the northwest, and the Little River, from the northeast, supply the river with an additional volume of water at its head.

The Wacissa runs in nearly a straight line due south through an almost impassable swamp from one-half mile wide near the head to 6 or more miles wide at or near its mouth. For about 7 miles the river flows with undiminished volume of water, and only a few small islands are met below this point, and all along its western shore several sloughs or branches, which meander through the widening swamp and debouch into the Aucilla River, diminishing the volume of water in the main river, and numerous islands divide it into several narrower channels. About 7½ miles below the head of the river the Wilaunee or Warrior River flows into the Wacissa from the east, and, in a great measure, replaces the amount of water lost through the branches on the west. The condition of the river remains the same until a distance of 12 miles from its head is reached, where the river is divided into several branches, which empty the main volume of its waters into the Aucilla River above the lower natural bridge, being, therefore, not available for navigation.

To obtain an outlet which would afford navigation to the Gulf a company was formed about 1856, which, with the assistance of State aid, opened a canal, entering the Aucilla below the natural bridges, for the purpose of affording navigation to its mouth.

This canal leaves the Wacissa River on the west side, about 12 miles from its head, just above the point where the river is divided into numerous small branches; and as the axis of the canal forms a considerable angle with the axis of the river, a dam was constructed by the company across the several outlets, to force a sufficient quantity of water into the canal to obtain a channel 3 feet deep and 30 feet wide.

This work was well planned but badly executed; the dam was constructed of unsuitable material, and, with the exception of a few rocks still remaining, was washed away, while three rock ledges in the lower portion of the canal were only excavated to a depth of 6 inches to 1 foot, thus preventing its use for navigation.

The dam has not been rebuilt, and the canal is choked up with grass and sunken logs, and its banks are overgrown with bushes and small trees overhanging the water.

The river was at the lowest stage at the time of my examination, but nowhere a depth of less than 3½ feet, with a minimum width of 70 feet, was found, affording a sufficient water-way for boats of 2½ feet draught, which could pass through the canal when deepened to 3 feet.

The bottom of the river is lime-rock, covered to various depths with silt, and wherever this occurs (fully two-thirds of its length) the channel is choked up with ribbon-grass, wild rice, saw-grass, and various other aquatic plants, which, with a number of sunken logs and overhanging trees, will require removal to open the channel to navigation.

The extreme rise and fall on the Wacissa is only 18 inches, while the Aucilla during freshets rises several feet, and covers the lower swamps as far as the head of the canal.

In 1880 a new company, under the name of the "Aucilla and Wacissa Navigation and Canal Company," was formed, which, however, has failed so far in accomplishing any results.

Under its direction a thorough reconnaissance of the river and canal was made by Mr. P. W. O. Koerner, civil engineer, and his report, with sketches, was kindly put at my disposal during my examination of the river by Mr. Thomas J. Moore, who accompanied me on my trip to the mouth of the canal, giving me full information as to location of the different points mentioned in said report and needing my special attention.

Based upon all data obtained and verified by my own observations, I submit the following approximate estimate of cost of improving Wacissa River to make it navigable for boats drawing 2½ feet at ordinary low water:

Removing sunken logs, overhanging trees, grass, &c., opening a clear channel-way 50 feet wide down Wacissa River, Florida, 12 miles, at $150 per mile....	$1,800
Cutting overhanging trees and clearing banks of canal for 12 feet on each side and cleaning out grass, 2½ miles, at $280 per mile....................	700
1,050 cubic yards rock excavation in canal, at $5 per cubic yard............	5,250
1,200 yards earth excavation in canal, at 50 cents per yard..................	600
650 cubic yards levee on canal, at 30 cents per cubic yard..................	195
600 cubic yards rock put in main dam, including necessary cribbing, at $4 ..	2,400
Boat with steam hoist and outfit...	4,500
Engineering expenses and contingencies	1,555
Total..	17,000

In this estimate I calculated the rock-dam to be raised to height of the medium stage of the water in the river, which, however, may not become necessary after the canal has been cleared of all its obstructions and a further reduction in the cost of this dam may occur by using the rock excavated from the shoals in the canal for its construction.

I have endeavored, with the data furnished me, as above stated, and my own observations, soundings, &c., to make this estimate complete and reliable, so as to make any further survey or examination unnecessary until actual work should begin.

There is at present no commerce carried on on this river. A few small boats pushed by pole through the grass carry fish from the mouth of the Aucilla to the head of the Wacissa, whence they are distributed through the up-country and find ready sale.

As to the probable amount of commerce which would be developed by the opening of this river I submit the following information, obtained from parties living in the vicinity and interested in the improvement:

The main object in making this river navigable is to open a market for pine, cypress, and other timber.

The pine belt tributary to this outlet extends for miles east and west from the head of the river, with a varying width of from 2 to 6 miles, and, as the distance to the nearest railroad is about 14 miles, over hilly roads, a water-way affording cheap transportation is the object desired.

There are also a large number of cattle raised through this entire pine-wood country, which are principally sold for export to Havana, and have to be carried by rail to Tampa at great loss and expense. With water transportation these cattle could be carried to Cedar Keys or Saint Mark's at a comparatively small expense and shipped hence direct to Havana.

I am also informed that a large surplus of grain is or could be raised in the country adjoining the timber belt on the north, said to contain the most fertile lands in Jefferson County, and the whole Gulf coast of South Florida could be suppled with corn from this source. If cheap water transportation could be obtained numerous other farm products would probably seek the same market.

Respectfully submitted.

R. RAUCHENSTEIN,
Assistant Engineer.

Maj. A. N. DAMRELL,
Corps of Engineers, U. S. A.

APPENDIX Q.

NSPECTION OF THE IMPROVEMENT AT THE SOUTH PASS OF THE MISSISSIPPI RIVER.

REPORT OF MAJOR W. H. HEUER, CORPS OF ENGINEERS, INSPECTING OFFICER, FOR THE FISCAL YEAR ENDING JUNE 30, 1886.

OFFICE UNITED STATES ENGINEER,
New Orleans, La., July 8, 1886.

GENERAL: I have the honor to submit my report for the fiscal year ending June 30, 1886, upon the improvement of South Pass of the Mississippi River.

The following charts accompany this report:

No. 1.—Chart of channel from opposite South Pass light-house to deeper water in the Gulf.
No. 2.—Chart of a part of the Gulf of Mexico, showing depths out to that of 100 feet.
No. 3.—Chart of South Pass, from South Pass light-house to Bayou Grande.
No. 4.—Chart of South Pass, from Bayou Grande to Head of Passes.
No. 5.—Chart of the Head of the Passes.
No. 6.—Plan and comparative profiles of South Pass.
No. 7.—Miscellaneous sections, profiles, curves, &c.
Plate I.—Diagrams explaining changes in the Gulf from 1877 to 1886.

Most of the subject-matter of this report is presented in such a manner on the above-mentioned charts and in tabular form, also by diagrams, throughout the report, that very little of a descriptive character is required. The methods of presenting results and making comparisons with earlier results, which have been followed for years, are still adhered to, and when understood they will be found very interesting.

AT THE HEAD OF THE PASSES AND IN SOUTH PASS.

No work has been done at the Head of the Passes since July, 1879, nor in the pass itself since November, 1883. All the dikes, dams, &c., comprising these structures are submerged, and the greater portion of them buried by sedimentary deposits. The piling which is above the surface of the water is badly decayed and is gradually disappearing; this, however, is of no importance since the mattresses are now secured by deposits upon them, and the works still maintain the channel created by them. The condition of these works and of the mattress-sills across Northeast and Southwest Passes has not changed materially during the year.

AT THE MOUTH OF SOUTH PASS.

The condition of the main jetties has not changed during the year, and no work has been done upon them. In fact, it is probable that nothing more will ever be done on the original jetties.

The east jetty is completely buried by deposits for a length of 5,000 feet from East Point; the next 1,300 feet has its upper surface about average flood tide; it is well ballasted with stone, and the water on either side of it being very shoal it remains permanent. It is also protected by the cribs on the sea-side of the jetty 6,300 feet below East Point. The 3,040 feet in length of masonry which was more or less injured by the storms of September 9, 1882, still acts as an effective barrier to the heavy seas, and therefore protects the inner jetty, which maintains the channel.

The masonry on the remainder of this jetty is in good condition and averages about 4 feet above average flood tide. During the year the average subsidence of this masonry was 0.13 feet, and for six years it is 1.35 feet.

West jetty.—Four thousand eight hundred feet of this jetty is buried by deposits, and throughout the remainder of its length it is capped with concrete blocks, which are in good condition and average about 1 foot above average flood tide except on the outer 300 feet, where they are two tenths of a foot below that plane. During the year the average settlement of these (154) blocks was one-tenth of a foot, andfor seven years it is 1.6 feet.

The rapid accumulation of sediment on the sea-side of this jetty renders it very permanent.

INNER EAST JETTY.

This jetty is shown on Chart No. 1; each of the parallel lines represent a row of piles, and between these rows willows ballasted with stone are placed. From time to time during the year willows and stone have been placed in this jetty, at localities where it had settled below the surface of the water, and at some points where it was found that a scouring was taking place under the jetty the willows were placed in such a way as to increase the width of the jetty and prevent such action.

At present this jetty is in fair condition, and from 1 to 5 feet above average flood tide. In its maintenance during the year the following materials were used, viz, 2,883 cords of willows, and 1,035 cubic yards of stone.

INNER WEST JETTY.

During the month of February work was commenced on the inner west jetty, which begins at △C, or at a point 7,000 feet below East Point. The objects of this jetty are, first, to prevent the escape of water at flood tide over the concrete blocks on the west jetty; second, to prevent the material which has accumulated between the wing-dams from being drawn into the channel by the swash produced by passing vessels; and, thirdly, to contract the water-way and increase the scour-power of the current.

This jetty has the general direction of the west jetty, is about 150 feet from it, and is parallel to and 675 feet from the inner east jetty. Throughout most of its length it is built in about 2 feet of water, and consists of 1, 2, 3, 4 and 5 rows of piles (as represented on Chart No. 1), according to

ality. The rows of piles are 8 feet apart, and the piles in each row
out the same distance apart; between the piles willows are placed
llasted with stone. Where there is but one row of piles the wil-
re placed so as to make the top of the jetty about 15 feet wide,
fficient stone to prevent them from floating placed upon them.
les in the two rows nearest the channel, and below Wing-dam 15,
osoted. This jetty is partially completed, except about 300 feet;
, willows and stone sufficient to check the flow of water over the
jetty have been placed in it. In its construction the following
als were used, viz: 1,192 piles (106 of which are creosoted), 3,505
of willows, and 1,252 cubic yards of stone.
onnection with and for the same purpose as the inner west jetty was
row of piles was driven between Wing-dams 27 and 29; parallel
west jetty and 10 feet from a row of piles which formerly sup-
a railway over the west jetty, willows were then placed between
two rows of piles and ballasted with stone. The length of this
re is 240 feet, and in it 29 piles, 296 cords of willows, and 70 cubic
of stone were used.

WING-DAMS.

ebruary, Wing-dam No. 27 was built, projecting from the west
00 feet above the end. This was for the purpose of correcting a
ng which had taken place in the channel opposite this point.
dam is 153 feet long and consists of 3 rows of piles 11 feet apart,
es in each row being 8 feet apart, those in the lower row being
ted together by 12 by 12 inch timbers, drift-bolted to them near
ops. The spaces between the piles are then filled with willows,
are ballasted with stone. In the construction of this dam the
ing materials were used, viz: 57 piles, 681 cords of willows, 186
yards of stone, 140 linear feet of 12 by 12 inch timber, and 17 drift-

n No. 28 connects the upper end of the inner west jetty with the
etty; it is 130 feet long, 12 feet wide, and consists of willows con-
between two rows of stakes and ballasted with stone. The ma-
used in this dam is included in the amount used in the inner west

n No. 29 connects the sea-end of the west jetty with that of the
west jetty, it is 136 feet long, 37 feet wide, and contains 5 rows of
two of which are 12 feet apart and the other 8 feet apart. The piles
h row are about 8 feet apart, and those in the two outer rows are
ted.
spaces between the piles are filled with willows, which are bal-
with stone. The following materials were used in this dam, viz:
s, 624 cords of willows, and 370 cubic yards of stone.
ns Nos. 9, 10, 11 and 15, all auxiliary to the west jetty, have
eir channel-ends rebuilt or repaired by the addition of the follow-
aterials, viz: 70 piles, 207 linear feet of 12 by 12 inch timber, 545
of willows, 141 cubic yards of stone, and 93 feet of ¾-inch chain.
dam connecting the sea-end of the east jetty with that of the
east jetty had 68 cords of willows and 232 cubic yards of stone
to it during the year, and is in good condition.
longitudinal dam or T-head of piles and lattice-work, which was
n 1881, connecting the outer ends of Dams No. 1 and 2 is gradually
earing, having become badly decayed.

DREDGING.

No dredging has been done at any locality since February 22, 1883.

THE PLANT.

During the year three steel barges, the dredge-boat, and a derrick-boat were repaired, a pair of ways built, and fifty-two mooring-piles driven at different points.

FORCE EMPLOYED.

The average force employed during the year, including officers, mechanics, and laborers, was 34 in number.

EXAMINATIONS AND SURVEYS.

The results of examinations and surveys made during the year were reported monthly, and these, together with earlier results, and also those deduced from the latest and more extended surveys, will be found in this report, and they are so compiled that, by studying the graphical representations and tabulated statements, one may gain detailed information concerning the present channels, the changes which have taken place, &c.

The results of tidal, sediment, and velocity observations are given on chart No. 7, and fully explained thereon.

AT THE HEAD OF THE PASSES.

The chart of this survey is No. 5, and on chart No. 7 will be found comparative profiles and sections which furnish information regarding the changes which have occurred during the year and since 1875.

On account of the width of section at this locality, where the river divides into three passes, its depth varies with the stage of the river; that is, the depth is greatest in high river and least during low river.

Using sections G H and I J, chart No. 7, it will be seen that the shoaling which took place above Upper Dam last year has been greatly reduced, and that now the tendency of the shoaling above this dam is to the westward, whereas last year it extended towards and well into Northeast Pass.

Comparative profiles E F show that the depth into Northeast Pass has increased an amount varying from 2 to 5 feet, in vertical height, above the mattress-sill and 9 feet below it during the year, and from 4 to 10 feet since 1875.

Profiles A B show that but little change has taken place during the year, or since 1875, in the entrance to South Pass above a point 1,000 feet above Upper Dam. Below that point it has deepened in some places and shoaled in others during the year. The great deepening which has taken place in the entrance to this pass since 1875 will be readily seen from these profiles.

Profiles C D show that Southwest Pass has deepened quite uniformly about 1.5 feet down to a point opposite Upper Dam, below which there has been but little change, and since 1875 this pass has deepened about 2 feet down to the mattress-sill.

From the above, therefore, we find that there has been a deepening during the year and since 1875, and again we note the fact that while the entrance to South Pass has been greatly deepened, those into the other passes have, in comparison, been but little changed.

On June 21 the least depth from the main river into South Pass was 32.4 feet, and the 30-foot channel was very wide.

SURVEY OF SOUTH PASS FROM ITS HEAD TO SOUTH PASS LIGHTHOUSE.

During the month of November a complete survey of South Pass was made, the charts of which are Nos. 3 and 4.

As compared with a similar survey made during the same month of the year previous, there has been a deepening in the pass. The greatest deepening took place in the deeper reaches while the shoaler ones in some cases shoaled and in others remained unchanged.

Picayune Bayou, Grand Bayou, and Goat Island reaches all shoaled, but since the river began to rise in January they have deepened again.

Since 1875 there has been a decided shoaling throughout the pass, as will be seen from an inspection of the comparative profiles on chart No. 6. These profiles give a complete record of the changes in the channel from the main river, throughout South Pass, and through the jetties, to the Gulf, and will be found interesting.

On June 21 the least depth in the pass was in the reach above Goat Island, which had a central depth of 29.8 feet, and the 26-foot channel was 300 feet wide.

On the same day there was a central depth of 30 feet in Grand Bayou and Picayune Bayou reaches.

At other localities throughout the pass the depth and width of channel is substantially as shown on charts 3 and 4, from which the following table was compiled:

Tabulated statement of the depth and width of channel throughout South Pass of the Mississippi River, from East Point to 30-foot depth in the main river, given in separate reaches, one-fourth of a mile in length, from a survey made in November, 1885.

From—	To above East Point.	Least available depth.	Least width for 26-foot depth.	Least width for 30-foot depth.	From—	To above East Point.	Least available depth.	Least width for 26-foot depth.	Least width for 30-foot depth.
East Point	¼ mile	30.1	310	30	Above East Point:				
Above East Point:					4 miles	4¼ miles	36.6	400	310
¼ mile	½ mile	30.1	410	130	4¼ miles	4½ miles	34 8	450	340
½ mile	¾ mile	32.1	350	200	4½ miles	4¾ miles	37.6	440	330
¾ mile	1 mile	34.0	310	180	4¾ miles	5 miles	37.5	360	220
First mile		30.1	310	30	Fifth mile		34.8	360	220
1 mile	1¼ miles	31.8	340	150	5 miles	5¼ miles	29.7	340	(3)
1¼ miles	1½ miles	30.7	380	70	5¼ miles	5½ miles	29.6	470	(4)
1½ miles	1¾ miles	28.4	440	(1)	5½ miles	5¾ miles	28.5	310	(5)
1¾ miles	2 miles	28.8	430	(2)	5¾ miles	6 miles	29.1	300	(6)
Second mile		28.4	340	......	Sixth mile		28.5	300	......
2 miles	2¼ miles	31.4	450	340	6 miles	6¼ miles	29.4	400	(7)
2¼ miles	2½ miles	35.4	430	390	6¼ miles	6½ miles	30.4	420	130
2½ miles	2¾ miles	37.3	420	380	6½ miles	6¾ miles	33.4	400	300
2¾ miles	3 miles	36.2	430	380	6¾ miles	7 miles	35.5	400	300
Third mile		31.4	420	340	Seventh mile		29.4	400	130
3 miles	3¼ miles	35.2	410	300	7 miles,	7¼ miles	33.5	480	270
3¼ miles	3½ miles	32.1	410	230	7¼ miles	7½ miles	32.5	450	310
3½ miles	3¾ miles	30.7	420	230	7½ miles	7¾ miles	38.6	340	290
3¾ miles	4 miles	34.0	410	290	7¾ miles	8 miles	43.5	340	270
Fourth mile		30.7	410	230	Eighth mile		32.5	340	270

Tabulated statement of the depth and width of channel throughout South Pass of the Mississippi River, &c.—Continued.

From—	To above East Point.	Least available depth.	Least width for 26-foot depth.	Least width for 30-foot depth.	From—	To above East Point.	Least available depth.	Least width for 26-foot depth.	Least width for 30-foot depth.
Above East Point:					Above East Point:				
8 miles	8¼ miles	37.4	360	270	10 miles	10¼ miles	40.4	300	270
8¼ miles	8½ miles	35.5	380	260	10¼ miles	10½ miles	40.0	330	270
8½ miles	8¾ miles	34.4	270	200	10½ miles	10¾ miles	40.5	330	200
8¾ miles	9 miles	36.4	250	180	10¾ miles	11 miles	33.6	400	350
Ninth mile	....	34.4	250	180	Eleventh mile	....	33.6	300	200
9 miles	9¼ miles	34.2	250	150	11 miles	11¼ miles	40.4	(*)	720
9¼ miles	9½ miles	28.2	370	(8)	11¼ miles	11½ miles	28.8	(*)	(9)
9½ miles	9¾ miles	31.1	380	260	11½ miles	11¾ miles	27.8	(*)	(10)
9¾ miles	10 miles	47.3	330	290	11¾ miles	12 miles	†30	......	......
Tenth mile	....	28.2	250	......	Twelfth mile	....			

*Very wide. †In Mississippi River above Head of Passes.

Length of the portion of this reach lacking a central depth of 30 feet.

	Feet.		Feet.		Feet.
(1)	1,180	(5)	800	(9)	750
(2)	340	(6)	430	(10)	900
(3)	200	(7)	390		
(4)	470	(8)	700	Total length of channel	6,160

THE CHANNEL THROUGH THE JETTIES.

The channel through the jetties is shown on Chart No. 1. As compared with a survey made one year ago, this channel has deepened during the year, and particularly below where the inner west jetty begins. In places the depth has increased 14 feet, the average deepening being about 5 feet.

During the months of September, October, November, December, and January this channel shoaled throughout, in consequence of the sediment brought down by those short crises which occurred during those months. Had the river continued to rise, the current would have been increased sufficiently to have carried the sediment into the Gulf, but, after rising about 4 feet it would then fall about the same amount, the current would be decreased in velocity, and the sediment deposited. There was sufficient margin over the required depth, so that the channel did not shoal to less than that depth, except between the ends of the jetties, where for seventeen days (from January 25 to 29, inclusive, and from February 5 to 16 inclusive) the required channel did not obtain.

At the time this deficiency occurred the concrete blocks on the west jetty, opposite to where the shoaling took place, were submerged at flood tide, and therefore the flood water was not concentrated in the channel; on the contrary, the flood-tide cross-section was greatly increased, and, combined with the effect of the fluctuations in the stage of the river, as a natural consequence, caused a shoaling.

The changes which have taken place in the depth and width of the jetty channel from month to month during the year will be seen from the following table:

lated statements regarding the minimum depths and widths of channel through the jetties, ieparate reaches of 2,000 *feet each, according to surveys made monthly during the fiscal :r ending June* 30, 1886.

DISTANCE FROM EAST POINT.

Date.	0 to 2,000 feet.			2,000 to 4,000 feet.			4,000 to 6,000 feet.		
	Least depth.	Least width for—		Least depth.	Least width for—		Least depth.	Least width for—	
		26 feet depth.	30 feet depth.		26 feet depth.	30 feet depth.		29 feet depth.	30 feet depth.
1885.									
	34.7	330	190	33.7	340	300	35.7	360	270
	36.3	330	200	33.1	350	290	36.5	370	290
st	36.5	340	180	35.6	300	310	37.6	370	300
mber	35.3	330	170	33.3	350	300	35.2	380	300
er	33.8	310	170	33.7	360	310	35.8	350	280
nber	32.7	280	160	32.8	330	280	35.1	360	260
uber	33.0	300	160	32.2	330	260	34.2	360	220
1886.									
ry	33.6	290	140	32.5	320	250	33.0	340	200
ary	32.8	320	190	32.8	350	310	34.1	350	240
	32.8	310	170	35.8	330	280	34.0	360	220
	35.4	310	180	34.5	350	280	34.5	360	230
	35.9	330	210	35.6	360	300	34.2	370	220
	38.2	350	200	35.2	370	300	33.4	380	280

Date.	6,000 to 8,000 feet.			8,000 to 10,000 feet.			10,000 to 12,000 feet.		
	Least depth.	Least width for—		Least depth.	Least width for—		Least depth.	Least width for—	
		26 feet depth.	30 feet depth.		29 feet depth.	30 feet depth.		26 feet depth.	30 feet depth.
1885.									
	32.8	270	160	32.8	280	130	31.3	270	130
	33.7	300	180	33.6	330	150	31.0	310	130
st	33.0	320	170	32.0	290	130	31.0	280	110
nber	32.2	300	170	30.7	260	110	31.7	240	110
er	31.3	270	120	30.4	230	90	30.4	210	60
nber	30.8	250	100	30.6	230	90	30.1	220	30
nber	30.9	220	90	30.5	220	50	30.6	210	30
1886.									
ry	30.2	220	40	30.2	185	40	28.5	185	....
ary	31.3	225	100	30.9	230	65	30.0	200	45
	35.0	230	130	33.1	240	180	32.0	280	130
	33.7	230	150	33.7	240	200	31.0	270	100
	31.0	270	180	36.0	300	220	34.5	300	210
	33.2	240	170	34.5	320	240	36.5	330	240

ıe least depth at any point in a channel is the most important, and efore in these statements only that depth is given. By reference ıe profile on Chart No. 6 one may know the depth of water at every ıt throughout this channel, and it will be seen that but a comparaly short reach in it has a less depth than 35 feet.

ccording to the above table the least depth through the jetties at sent is 33.2 feet; the least width of the 26-foot channel is 240 feet, of the 30-foot channel 170 feet.

eyond the ends of the jetties there is a central depth of 31.2 feet, the 26 and 30 foot channels are, respectively, 260 and 190 feet wide.

he following table gives the minimum depths of channel through jetties at various dates since the commencement of the works of rovement, and serves to show the progressive channel improvement n that time to the present.

[illegible] through the jetties at various dates.

Distances from East Point, in feet.

[illegible]	2,000 to 4,000.	4,000 to 6,000.	6,000 to 8,000.	8,000 to 10,000.	10,000 to 12,000.
22.5	18.7	16.7	10.2	9.7	9.2
23.3	20.8	22.0	21.0	17.1	15.0
23.5	19.6	21.0	23.5	23.0	19.8
22.0	20.3	21.1	21.2	21.1	20.3
24.1	21.1	23.2	22.0	21.2	20.5
24.9	24.0	26.0	23.8	23.5	20.3
26.3	24.4	28.5	24.2	23.0	23.7
26.0	25.9	35.5	25.4	24.3	23.0
28.4	26.4	35.7	27.1	25.3	22.0
28.6	27.5	43.4	27.0	27.0	27.0
27.5	28.4	47.7	29.2	29.2	28.0
30.5	30.7	....	31.0	30.7	30.5
31.0	31.0	48.3	31.7	31.8	30.8
31.0	32.5	47.8	31.4	35.1	32.0
30.5	31.0	44.0	30.8	31.5	30.5
30.5	30.4	46.0	32.0	32.0	30.5
30.7	31.0	44.4	30.6	32.0	31.0
31.0	31.5	41.0	30.3	21.0	30.5
30.6	31.0	40.3	30.8	30.9	30.5
30.9	30.6	43.0	30.8	31.0	30.3
30.5	30.4	41.9	33.8	30.7	30.3
30.4	30.2	41.6	32.0	31.0	30.0
31.5	31.2	41.3	32.0	32.0	30.5
30.4	30.0	43.0	33.0	33.0	30.5
30.2	30.5	42.7	32.6	30.5	31.2
30.0	30.5	43.8	32.0	31.7	31.7
31.0	32.0	42.5	33.5	33.0	32.0
30.1	32.0	37.6	32.0	31.0	30.2
30.2	30.3	38.3	31.4	31.2	30.3
30.8	31.8	39.2	30.4	30.0	30.1
30.2	32.8	39.4	30.8	30.2	30.0
30.5	30.4	41.3	31.1	30.2	30.7
31.8	36.0	30.7	30.5	30.8	30.2
31.2	30.6	39.2	30.8	31.6	32.5
31.7	32.6	39.6	30.5	30.3	33.0
30.5	32.5	39.4	31.0	31.3	31.0
30.8	35.5	39.0	31.2	31.3	31.0
30.0	32.7	38.7	30.6	31.3	31.5
30.3	32.2	38.1	31.8	31.8	30.5
30.1	31.5	38.8	31.9	30.8	30.5
30.0	31.0	37.1	31.0	31.4	31.2
30.0	32.0	38.1	21.5	31.2	31.2
31.0	31.0	37.0	31.2	31.0	30.4
31.0	31.0	35.2	30.2	30.1	30.1
31.2	31.2	36.0	30.5	30.0	30.1
32.3	32.6	45.7	31.5	30.3	30.3
33.7	35.0	44.0	32.2	30.0	30.0
33.2	36.3	46.0	32.3	30.3	32.4
32.5	34.2	45.0	33,4	31.0	33.0
33.8	34.9	44.0	32.0	31.5	31.8
32.1	38.2	48.0	33.4	33.4	32.2
33.4	34.3	46.0	32.3	32.3	30.6
32.7	34.1	41.5	32.0	32.0	30.5
31.0	33.8	43.8	34.5	31.5	31.0
30.5	32.6	43.0	31.6	31.6	30.2
31.2	32.2	39.2	32.7	31.8	30.3
32.0	31.5	41.3	31.6	31.0	30.7

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ble giving the depths of water through the jetties at various dates—Continued.

Date.	Distance from East Point, in feet.					
	0 to 2,000	2,000 to 4,000.	4,000 to 6,000.	6,000 to 8,000.	8,000 to 10,000.	10,000 to 12,000.
1884.						
	35.7	39.5	41.6	34.0	33.8	33.7
	35.8	37.3	41.5	31.7	32.7	35.4
	34.9	35.8	42.3	34.3	35.1	33.0
	35.0	35.8	41.1	34.0	35.0	35.0
	31.9	35.8	41.9	33.9	35.0	32.0
er	32.0	34.0	39.0	33.1	33.7	33.5
	31.1	33.4	38.6	32.6	32.6	32.5
er	32.8	32.8	37.2	32.2	32.4	30.8
er	31.6	32.6	37.1	31.1	31.5	31.4
1885.						
	36.7	36.4	36.9	33.1	34.6	32.8
y	41.7	36.3	35.7	30.5	34.1	36.2
	35.5	36.0	36.1	31.0	31.7	35.7
	36.0	35.5	37.0	32.0	32.6	32.0
	36.7	35.0	35.6	31.5	33.5	31.5
	34.7	33.7	35.7	32.8	32.8	31.3
	36.8	33.1	36.5	33.7	33.6	31.0
	36.5	35.6	37.6	33.0	32.0	31.0
er	35.3	33.3	35.2	32.2	30.7	31.7
	33.8	33.7	35.8	31.3	30.4	30.4
er	32.7	32.8	35.1	30.8	30.6	30.1
er	33.0	32.2	34.2	30.9	30.5	30.6
1886.						
	33.6	32.5	33.0	30.2	30.2	28.5
y	32.8	32.8	34.1	31.8	30.9	30.0
	32.8	35.8	34.0	35.0	33.1	32.0
	35.4	34.5	34.5	33.7	33.7	31.0
	35.9	35.6	34.2	31.0	36.0	34.4
	33.2	35.2	33.4	33.2	34.5	36.5

SURVEY BEYOND THE ENDS OF THE JETTIES.

chart of this survey is No. 2. The survey extends to a depth of et of water, which is about 1½ miles beyond the ends of the jetties. reference to Plate I, the note on which fully explains the results n, it will be seen that the 20, 30, 40, and 50 feet curves advanced the year, and that all the crest receded, the 60-foot curve showing tle change. These results are exactly the reverse of those obtained ear, and show that whatever shoaling has taken place during the as been in a lesser depth than 60 feet of water.

following diagram gives the amount that each curve has advanced 1877. Taking the results in 1877 as a basis for comparison, the it that each curve has advanced since then will be the difference en its mean ordinate for 1877 and that for 1886. For example, we at from 1877 to 1886 the 70-foot curve advanced 899 feet, &c. urve shows the greatest advance, and the 20-foot curve shows the

heretofore shown, and as a well-established fact, the curves of depths show the greatest advance on the westward and the least e eastward, while generally the central portion advances the

From an examination of Chart No. 2 it will be seen that but two curves which show a recession are within the area which is com- by mean depths, and since the majority of the curves within that area shows an advance, it indicates that the general result will be a shoaling.

This area contains 1¼ square miles, and is subdivided into 21 lesser areas. The mean depth of each and then of the whole area is determined and compared with earlier results similarly obtained, and in this way we may locate the areas which are undergoing the greatest or least change—that is, we may show how the material deposited is distributed over this area.

The results of these determinations are as follows, viz:

	Feet.
Mean fill over whole area from 1885 to 1886	0.12
Mean fill over whole area from 1876 to 1886	7.25

A clear understanding of the change in each subdivision of this area will be readily obtained from the following diagrams, which represent it on a small scale.

The figures in each subdivision are the differences between the mean depths of each division as obtained for the years between which the comparisons are made, and therefore express in feet and tenths of a foot the vertical height of the deepening or shoaling in each.

Shaded areas are those which have shoaled, and blank areas have deepened.

No. 1 gives the results obtained by comparing the depths for 1885 with those for 1886, and No. 2 compares those for 1876 with those for 1886.

The results on No. 2 confirm those deduced in the comparisons by mean ordinates, and likewise show that the greatest shoaling westward of a line which is the prolongation of the west jetty is near the end of that jetty, while to the eastward of a line, which is the prolongation of the last jetty the shoaling is greatest in the division most remote from the end of that jetty; and, finally, that the central areas, or those directly in advance of the jetties, have shoaled the least.

RECAPITULATION.

From the preceding results it will be seen that the least depth at any point throughout the channel from the main river to the Gulf of Mexico is 29.8 feet, and the least width of the 26-foot channel is 240 feet.

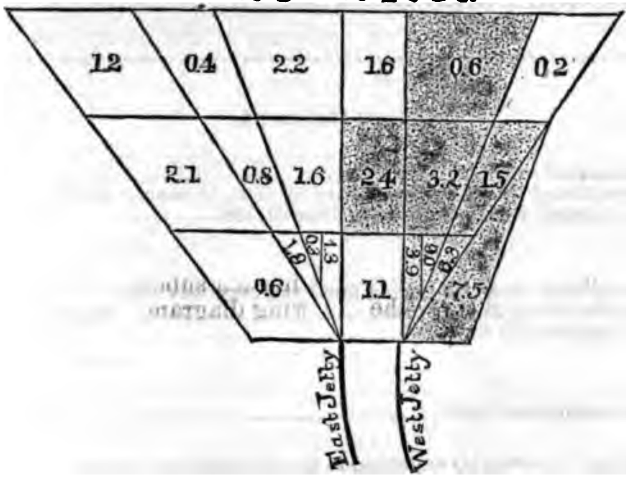
Since August 1, 1882, with the exception of seventeen days previously mentioned, there has been "a channel through the jetties 26 feet in depth, not less than 200 feet in width at the bottom, and having through it a central depth of 30 feet without regard to width;" also through the shoal at the head of South Pass, and "through the Pass itself," there has been "a channel having a navigable depth of 26 feet."

VESSELS AGROUND.

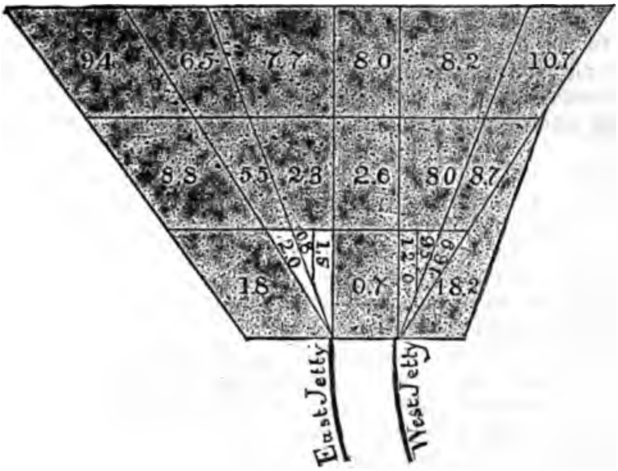
But three vessels were aground during the year, one near the foot o Crane Island, and two on the lump beyond the ends of the jetties, whic is now marked by a spar-buoy. One of these vessels was drawing 24 feet. In each case it was stated that the vessels "handled badly."

The depth of water in the channel was measured as soon as the ve sel grounded, and the fact established that it was not for want of dept of water that these accidents occurred.

No. 1. 1885 to 1886.



No. 2. 1876. to 1886.



ATE OF FUNDS REQUIRED FOR EXAMINATIONS AND SURVEYS AT SOUTH PASS F THE MISSISSIPPI RIVER FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

stant engineers	$4,500
rder	1,200
engineer	1,200
-level observer	120
men	4,680
office	180
assistant engineers' quarters	240
and traveling expenses	200
launch and office	350

Repairs to launches and boats ....
Supplies for launches and office ....
Contingencies ....

Total ....

Money statement.

July 1, 1885, amount available ....
Amount approprlated by act approved May 26, 1886, to supply defici
in amount required for expenditure to June 30, 1886 ....

July 1, 1886, amount expended during fiscal year, exclusive of
liabilities outstanding July 1, 1885 .... $9, 1
July 1, 1886, outstanding liabilities ....

July 1, 1886, amount available ....

Amount that can be profitably expended in fiscal year ending June 30,

CONCLUSION.

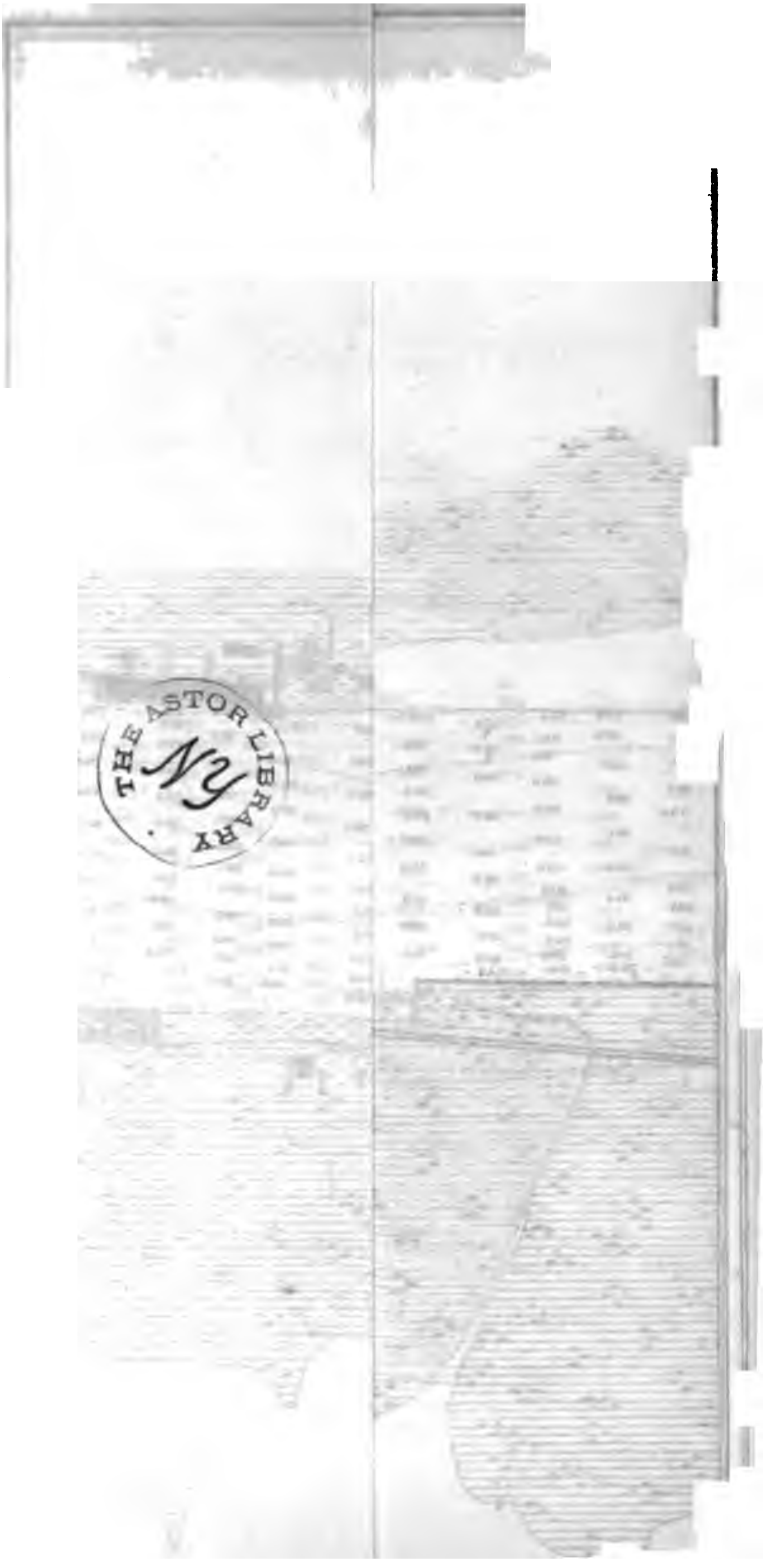
The duty which involves upon me as inspecting officer
is such as to require that I keep a party employed at
order that I may be prepared "to report the depth of wa
of channel secured and maintained from time to time in
together with such other information as the Secretary of
rect."

On December 1, 1875, the available funds for this v
hausted, and as I am prohibited by law from incurrin
tions beyond appropriations made, I was unable to ask
party of employés to continue their services after that
however, voluntarily continued their services, relieving th
from any obligation to pay them for the same, unless Con
rily appropriated funds for that purpose.

They continued their services seven months before rec
muneration, and for the information furnished during t
for the subject-matter of this report, all of which is of i
commerce and the Government, I am indebted to them.

In view of the fact that Mr. Eads may claim his quarte
whether examinations and surveys are made or not, and i
commercial importance of this work, and of the interest w
ernment has involved, and again that the series of va
deduced from these surveys may not be interrupted, I v
fully suggest that the appropriation for this work be n
pendent measure, as is the appropriation from which the
paid.

I would again respectfully invite attention to the impo
cessity of authorizing the enforcement of rules regulating t
of South Pass, and also of driving mooring piles along th
the pass.



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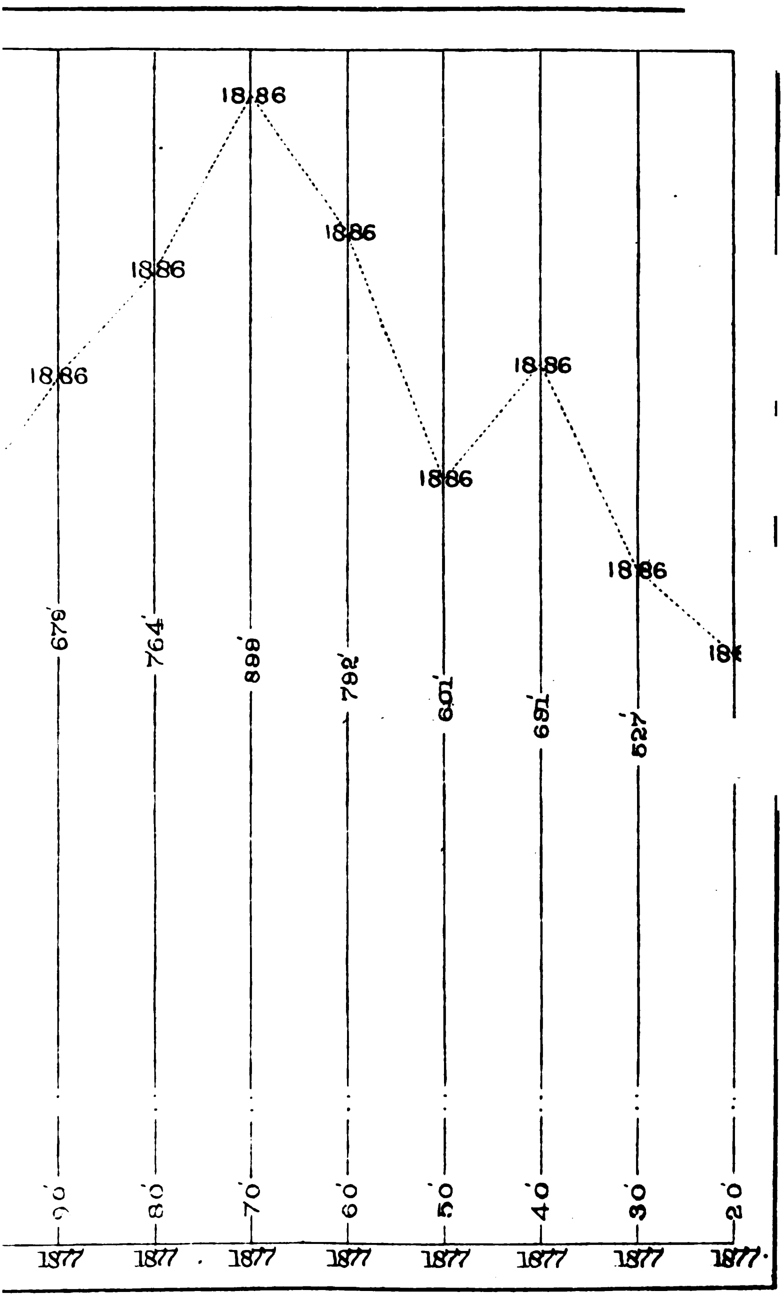

1886
1886
1886
1886
1886
1886
1886
1886
18
679
764
899
792
601
691
527
90
80
70
60
50
40
30
20
1877
1877
1877
1877
1877
1877
1877
1877

hese two measures are of great commercial importance in protecting safety of the navigation of South Pass.

y thanks are due Mr. C. Donovan, the able assistant in local charge he examinations and surveys herein shown, for all the information raced in the report, as well as for the report itself.

espectfully submitted.

W. H. HEUER,
Major of Engineers.

o the CHIEF OF ENGINEERS, U. S. A.

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APPENDIX R.

MENT OF VARIOUS WATER-COURSES IN THE STATE OF LOUISI-
MPROVEMENT OF SABINE PASS AND OF SABINE AND NECHES
, TEXAS.

OF MAJOR W. H. HEUER, CORPS OF ENGINEERS, OFFICER IN
E, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, WITH OTHER
ENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- iver, Louisiana.
- hoa River, Louisiana.
- cte River, Louisiana.
- River, Louisiana.
- Teche, Louisiana.
- ting Bayou Teche with Grand at Charenton, La.
- Black, Louisiana.
- Courtableau, Louisiana.
- Terrebonne, Louisiana.

10. **Bayou La Fourche, Louisiana.**
11. **Calcasieu River, Louisiana.**
12. **Calcasieu Pass, Louisiana.**
13. **Sabine Pass, Texas.**
14. **Sabine River, Louisiana and Texas.**
15. **Neches River, Texas.**
16. **Removing sunken vessels or craft obstructing or endangering navigation.**

OFFICE UNITED STATES ENGINEERS,
New Orleans, La., July 8, 1886.

RAL: I have the honor to transmit herewith my annual reports
scal year ending June 30, 1886, for the works of improvement
ninations and surveys in my charge.

ery respectfully, your obedient servant,

W. H. HEUER,
Major of Engineers.

Gen. JOHN NEWTON,
ief of Engineers, U. S. A.

R 1.

IMPROVEMENT OF AMITE RIVER, LOUISIANA.

iginal project for improving this river was adopted in 1880, the
ing to obtain a channel of navigable width and 5 feet depth at
r, or as near that as possible without dredging, from the junc-
 Bayou Manchac continuously up-stream as far as the appro-
would permit. By act of Congress approved June 14, 1880, the

ld respectfully recommend that this plant be retained until the of the next Congress, then if there are no appropriations made above works that the plant be sold.

ecommendation was approved by the Chief of Engineers, United Army, November 17, 1885.

alue of the commerce of this river is estimated at $250,000 an- the principal products being sugar, molasses, staves, shingles, and wood.

d any further appropriation be made for this work it will be used nuing the project as made.

Money statement.

85, amount available	$121 99
86, amount expended during fiscal year, exclusive of liabilities nding July 1, 1885	120 00
86, amount available	1 99
ppropriated by act approved August 5, 1886	2,000 00
vailable for fiscal year ending June 30, 1887	2,001 99
t (estimated) required for completion of existing project	6,205 00
t that can be profitably expended in fiscal year ending June 30, 1888	6,205 00

ted in compliance with requirements of section 2 of river and or acts of 1866 and 1867.

R 2.

IMPROVEMENT OF TANGIPAHOA RIVER, LOUISIANA.

ppropriation was made in 1872, and was expended in clearing ar of snags, rafts, and leaning trees over a distance of 16 miles s mouth.

ination and survey were authorized June 18, 1878. The survey gun in 1879. The assistant engineer who made the survey found bstructions, such as snags, overhanging trees, &c., and estimated t of their removal up to Connor's Bridge, 1½ miles from Amite d 58 miles above the mouth, at $10,000. This improvement give a clear channel 42 inches deep to a point 32 miles above the and for a farther distance of 21 miles a clear channel of 24

ppropriation of $5,000 was made June 18, 1880. On September , agreement was made with Carl P. Segmet for clearing 34 miles sum of $4,750.

arch 3, 1881, an appropriation of $2,000 was made for continu- improvement. The approved project for expending this sum d for continuing the work above the point to be reached by first t. One bid was received on this, and, being considered excessive, ected. The first contract was reported completed in November, nd the work was accepted. On January 3, 1883, a contract was ith C. E. Cate for clearing out 7¼ miles, at $235 per mile. The as accepted late in June, 1884, having been reported twice as d and twice rejected.

uly 22, 1884, the charge of this work was transferred to Capt. s Turtle, Corps of Engineers, by Maj. Amos Stickney, Corps of d part for the construction of a breakwater extending 820 feet into e lake.

The original estimate for improving this river was $5,460, the greater rtion of which was for dredging the bar at the mouth. It was ought, however, that a dredged channel over this bar could not be intained without protecting works, which would cost considerably re than the dredging.

Major Stickney, who had this work in charge, caused a re-examination to be made in 1884, and in his report in the Annual Report of the ief of Engineers for 1874, vol. 2, page 1269, he reports the river in od order, excepting the bar at its mouth, and suggests, as a method r improving the bar to build a jetty or breakwater 2,500 feet long ross the bar into the comparatively deep water of the Lake Pontchartain, and then to dredge the channel through the bar, in the hope that e jetty would prevent, or at all events greatly retard, the refilling of e cut with sand. The estimated cost of this improvement is $20,400, d, if authorized by Congress, $19,000 of this amount should be appropriated for the fiscal year ending June, 30, 1888, and applied to tending the breakwater, dredging the bar, and removing any other structions that may have formed since the river was cleared out. hould the improvement be made as contemplated, the protection of e mouth of the river would also enable vessels navigating the lake to e this mouth as a harbor of refuge in case of gales. The depth of ater on the bar at its lowest stage (during a norther) is about 4½ feet. The improvement thus far made has not been of any material benefit commerce.

The report of 1884 estimates the annual value of the products carried own the river at $106,500, consisting of sugar and molasses, cotton, ool, brick, sand, charcoal, lumber, beef, and hides.

The improvement, if made, will be of local benefit only, and cannot e considered permanent, as the obstructions will eventually re-form.

No work has been done during the past fiscal year, no money being vailable. The work is located in the collection district of New Orleans; e nearest light-house is at the mouth of the river.

I append First Lieut. O. T. Crosby's report upon an examination of e mouth of the Tchefuncte River, Louisiana.

Money statement.

Amount (estimated) required for completion of existing project........	$19,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	19,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

REPORT OF LIEUTENANT O. T. CROSBY, CORPS OF ENGINEERS.

NEW ORLEANS, LA., *July* 3, 1885.

SIR: I have the honor to report as follows upon an examination of the mouth of hefuncte River, Louisiana, made by me on July 1, in obedience to your verbal orers. I was assisted by Mr. C. D. Anderson.

With transit and stadia the position of the partially completed jetty was deterined and lines of soundings directed. The results have been plotted and the chart herewith submitted. Comparing it with that made before the jetty was built, it ill be seen that the lines are nearly the same. The distance between and the dictions of the 6-foot curve on the outer slope of the bar and the inner 4-foot curve e almost exactly the same. Some changes between these in the positions of the 5-ot curves are observable, but they are immaterial. Substantially it may be said at no effect has been produced, nor could any be expected before the building of

No work on the branches of the Tickfaw has been done.

The commerce of the four streams is carried by about 15 schooners per week. The benefit to commerce resulting from the improvement f this stream is purely local. It would result in very little advantage o improve navigation any higher up in the Tickfaw, but the branches f this stream, the Blood, Natalbany, and Ponchatoula, are in need of mprovement, and are part of the project estimated for in 1880. It is, herefore, recommended that no further appropriation be made for the ickfaw unless the money so appropriated can be applied to the branches eferred to. In this event, the $6,230 estimated for will complete the hole project estimated for.

Nothing has since been done on this river other than that necessary or the care of the plant now laid up at Springfield, La.

Money statement.

July 1, 1885, amount available	$33 72
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	30 00
July 1, 1886, amount available	3 72
Amount appropriated by act approved August 5, 1886	2,000 00
Amount available for fiscal year ending June 30, 1887	2,003 72
Amount (estimated) required for completion of existing project	4,230 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	4,230 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

R 5.

IMPROVEMENT OF BAYOU TECHE, LOUISIANA.

On May 5, 1870, an appropriation of $500 was made for a survey and stimate of cost of improvement of Bayou Teche. The survey having een made and reported, an appropriation of $17,500 was made July 11, 1870. With this money much relief was given by removal of natural nd artificial obstacles, such as overhanging trees, snags, and wrecks etween the mouth and Saint Martinsville, a point about 65 miles above he mouth. The work was done by hired labor, and for a sum considerably less than that appropriated, Captain Howell, the officer in charge, aving found it best to abandon some features of the original project, uch as the cutting of brush along the bank.

March 3, 1879, an examination of this bayou was authorized by Congress, a report of which, together with plans and estimates, was published in Report of Chief of Engineers for 1880, Appendix M. The improvement recommended in this report had in view the obtainment of lackwater navigation as far up as Léonville, about 109 miles from the mouth and 13 miles from the head of the bayou. Three timber locks with needle-dams were recommended, besides removal of snags, &c. he total estimate of costs was $58,190, of which $45,000 was for the hree locks and dams, of 7-foot lift each. No clearing of the river for he 13 miles above Léonville was provided for, as the information obtained in the reconnaissance of 1879 led to the belief that there was no water for the passage of boats except at extreme floods. This report as submitted February 27, 1880. On June 14, 1880, an appropriation

n as to low-water discharge of the bayou, this important element of
problem was determined in September, 1885, Lieutenant Crosby
king the observations. My letter transmitting the report submitted
me by Lieutenant Crosby, together with that report, are given here-
h as containing the results of investigations and my recommenda-
ns thereon. In my last annual report it was stated:

> do not recommend any appropriation for slackwater improvement until the ne-
> ity for such improvement is made absolutely necessary, and certainly not until the
> s, trees, stumps, &c., now known to be in the upper part of the bayou are re-
> ved and the effect of their removal is seen in the improved navigation.

During the past fiscal year a large part of the work referred to in the
ve paragraph has been accomplished. At the date of my last an-
l report, the United States Snag-boat was working between New
ria and Saint Martinsville. Under the direction of Lieutenant Cros-
the snagging operations were continued about 10 miles above Saint
rtinsville. At this point the boat was prevented from going fur-
r by the low stage of water, September, 1885. A land party was
n organized, which began work about 3 miles above Breaux Bridge
d about 8 miles above the point where the boat stopped work. These
iles were too deep for successful working of a land force and more-
r were comparatively free from obstructions.

he land party cleared about 15 miles of the very shallow and much
tructed portion of the bayou.

hey reached a point about 5 miles above Arnaudville, the last village
t in ascending the Teche, 19 miles from its head. Throughout the
miles still untouched the bayou is narrow, tortuous, and overgrown
h large trees. The work of the land party was stopped by high
ter in January, 1886.

he snag-boat which had been put at work on the lower bayou dur-
the very high water on the upper part, removed all serious obstruc-
ns between New Iberia and Franklin, below which point no trouble
xperienced.

n January, although the water at Breaux Bridge was still too high
the most successful work with the snag-boat, it was ordered up to the
ile stretch, previously omitted, and the worst obstructions were re-
ved. In March, the water having risen higher, work was stopped,
d since then nothing has been done save for care of property.

As a result of this work, in February, 1886, there existed in the opinion
Lieutenant Crosby, who carefully examined the stream, a channel suf-
ent to permit a vessel 40 feet wide, drawing 5 feet, to ascend to a
nt 3 miles above Arnaudville, and 2 miles further except for the ob-
uction of a fixed bridge. The commercial effects may be judged from
e following correspondence:

NEW ORLEANS, LA., *June* 3, 1886.

ir: You will please report to this office all the reliable information you can obtain
to the number of steamboats or flats that have gone above Breaux Bridge since the
ation of work on the Teche, the size of such boats, the number and extent of their
s, and amount of freight carried. Also, whether you have any reports or authori-
ve opinion as to the navigation of the upper Teche.
y order of Major Heuer.

Respectfully,

O. T. CROSBY,
First Lieutenant, Engineers.

r. PETER OLIVER.

miles of the Teche I believe it to be impracticable to improve the 4.5 miles immediately below Port Barré for stream navigation, except an expense greatly in excess of any benefit to be derived from such provement. Occasionally, when the Little Teche is in a flood-stage, ges come down from the Courtableau, pick up what little freight of- s; they are polled or cordelled back to the Courtableau, the cargo nsferred to steamboats, and finds a much shorter water route to market New Orleans than would be possible via the Teche. The upper 6 miles the Little Teche is but little more than a gully; its banks are very ep, heavily timbered, and if it had, say 5 feet depth of water in it, width of water surface would scarcely average 20 feet. During a ge portion of each year this part of the bed of the bayou has no water it except in little pools; in fact this portion of the stream becomes y. When the bed of the Little Teche is dry and the Courtableau is w, the *bed* of the Teche is 8 feet above the *surface of the water* in the urtableau, and if a depth of 4 or 5 feet of water could be kept near e head of the Little Teche, it would have to be done by means of a m or wall in the Little Teche or a lock and dam in the Courtableau, or near Port Barré. If a lock and dam be built in the Little Teche, or near its head, vessels could not be locked into the Courtableau, cause of an insufficient water-supply, and if the lock and dam were ilt in the Courtableau, the cost of this lock and dam would probably greater than that estimated for by Lieutenant Crosby near Saint rtinsville in the Teche.

If a lock and dam should be built below Saint Martinsville, on the che, it would only benefit that section of country above; that is, the ges of Breaux Bridge, Arnaudville, and Leonville, and the planta- ns intermediate.

To Breaux Bridge the bayou is ordinarily navigable during ten nths of the year, and to Arnaudville, perhaps, for three months in e year. Leonville is a very small settlement of about two stores. By r the greater portion of the products of the country above Saint Mar- sville reach market at New Orleans by rail, and fully 90 per cent. of e output of this section of the country, though it may come down e bayou by boat, is transferred to the Morgan Railroad, either at organ City or the Atchafalaya, or at some other station, and then aches New Orleans by rail.

The products of the country for shipment above Saint Martinsville e cotton, sugar, and rice.

The statements concerning the amounts of each shipped in late years e very conflicting; with reference to cotton, reports vary from 2,300 to 000 bales. In 1884, 2,407 hogsheads of sugar were shipped from Saint rtinsville or above, while the total product for that year of the whole che was 21,659 hogsheads, or, in other words, only about 11 per cent. the sugar crop was raised in that portion of the country which would benefited by the improvement. The freight rates over that portion the route above Saint Martinsville are outrageous. Dry barrels, ch as sugar, flour, potatoes, &c., pay 25 cents per barrel, and wet bar- ls, such as beef, pork, &c., pay 40 cents per barrel, or, say, an average 18 cents per 100 pounds for from 15 to 20 miles of water transporta- on; or, to put the case more clearly, the ordinary freight rates on a rrel of flour from New Orleans to Breaux Bridge are 60 cents, of hich 35 cents goes for transportation to Saint Martinsville by rail, 140 les, or by boat 450 miles, and the other 25 cents for the 15 miles of ter transportation.

If we take the total amount of the products shipped to market from

are concerned. It now remains to be seen whether or not the im-
ment, which has certainly been of great benefit to navigation, has
of any benefit to the planters of this section of the country; and
recommendations are desired at this stage of the improvement,
ıld recommend that no appropriation for a lock be made until the
vement thus far made had been tested.
pectfully submitted.

W. H. HEUER,
Major of Engineers.

g. Gen. JOHN NEWTON,
Chief of Engineers U. S. A.

REPORT OF LIEUTENANT O. T. CROSBY, CORPS OF ENGINEERS.

OFFICE UNITED STATES ENGINEER,
New Orleans, La., February 1, 1886.

I have the honor to report as follows upon the measurement of the discharge
ou Teche, Louisiana.
observations were made at a point about half a mile below the Saint Martinsville
, over a straight stretch of 200 feet. Careful cross-sections were taken at
20 feet of this stretch, the soundings 5 feet apart. An almost perfect uni-
was discovered; the maximum depth found was 5 feet. I have plotted the
ross-section, and submit it with other plottings.
subsurface floats and wood-surface floats were used, their times of passage
opes stretched across the stream at upper and lower extremities of the 200-foot
being noted. The ropes were marked to every 5 feet. The floats were dropped a
t above the upper one and opposite predetermined marks, so that time only was
bserved there. Both time and position were marked at the lower rope, and the
ecovered by a man in a skiff. Shortly after beginning the work I settled upon
ar set of observations, consisting of five surface, five 1-foot, three 2-foot, three
one 3½-foot subsurface, sixteen in all, made every three or four hours during
ht. At midnight one or two observations were made at a depth of 2 feet, where
locity was closely proportioned to the mean. A regular nightly decrease is
by these observations, and their effect upon the mean shows the importance of
ing observations throughout the twenty-four hours in all streams influenced in
gree by the tide. I was informed by parties living at Saint Martinsville that a
ıation of south wind ,high tide, and low water in the Teche will sometimes turn
rent up-stream. This state of affairs did not occur during the five days of my
ations, but the checking effect of the tide is shown in reduction of velocity from
r foot per second, the mean to .311, the minimum observed. Due to local rains
ou had risen nearly 1 foot the day before my arrival, thus preventing the meas-
ıt being made at extreme low water as desired; but before leaving the gauge
9 feet, the mean during low-water season of 1884 being 3.1 feet.
width of water was 95 feet, the area of cross-section 296 square feet when the
rement began. The variation from these figures was slight. The points of
ement were so distributed over the cross-sectional area as to make it unneces-
divide into sections and calculate for each separately. This was done at first,
tions being considered, but finding in each section, as in the whole, there was
nt of measurement to every 15 square feet of sectional area, I afterward neg-
this division. The mean velocity of all the floats was then taken as the mean
y for the stream. In order to obtain the curve of this mean velocity for the
time of observation the curve for each float was first plotted from the record,
e intervals of course being unequal, because but one was taken at night. The
ies at exact intervals of three hours were taken from these curves, and being
ed, the resulting ordinates were plotted to produce the mean curve. The daily
on was thus taken properly into account.
gauge-readings were also plotted. Then the discharge was calculated at the
the three-hour intervals and the results plotted. The relation between gauge-
gs, and velocity, or gauge-readings and discharge, for the time considered, could
seen. The law connecting these quantities, as shown during the time of ob-
on, can not, of course, be relied upon as existing at lower stages, but having
the curves showing the two relations, I adopted that giving the least result-
charge as the true one for use in calculating for stages lower than those ob-
This was found to be the curve showing the relation between gauge-readings

day, is the very lowest which would justify any expensive improvement of a waterway. It is, however, as great as would be found for some years after the construction of the canal, should that occur within the next six or eight years. It is usual to estimate upon a future development of canal navigation far beyond such a figure, and to be assured of a correspondingly greater water supply; but I desired first to determine the conditions for only a small increase of commerce over that now existing, considering that the assumption of a small increase would be at once more favorable to those interested in the improving, and more nearly approached to the truth as it would be developed after construction of the locks.

Preserving this estimate of boat passages, and adopting a mean of the two calculated deficiencies, it is seen that the shortage will be about 1,500,000 cubic feet per day during the continuance of a stage which the records show may last ten or fifteen days. To supply this deficiency in the simplest way suggested by known data the bayou itself may be made a reservoir.

The first or lower section of the canalized portion of the bayou has heretofore been spoken of as having its lower terminus about 5 miles below Saint Martinsville; upper terminus at Breaux Bridge, that being the point at which it has been proposed to build a second lock, carrying navigation to within 4 miles of Port Barré, the head of the bayou; both locks of 8 feet lift. But a lock of 10 feet lift about 5 miles below Saint Martinsville would give a depth of 8 feet as far up as Arnaudville, 15 miles above Breaux Bridge and 19 miles below Port Barré, the pool being supposed level, the most unfavorable case for depth up stream. This pool may be lowered 3 feet, leaving 5 feet navigation as far as Arnaudville. Estimating the average width of the bayou at 100 feet, we have a supply by this lowering of 100 feet × 3 feet × 35 miles=55,440 cubic feet. Increased seapage and evaporation over that calculated for the shorter pool will be about 500,000 cubic feet per day, making daily deficiency 2,000,000 cubic feet, which the lowering above referred to will supply for twenty-seven days.

Three feet navigation would be preserved to a point 5 miles above Arnaudville after lowering. This calculation supposes another lock to be eventually built at Arnaudville. Should there be no other, the length of the pool would be about 52.5 miles, the supply by lowering 83,160,000 cubic feet, the daily shortage about 2,400,000; 83,160,000÷2,400,000=34.9 days. A lock having 12 feet lift would preserve 5 feet navigation after a fall of 5 feet at Arnaudville. The supply from such lowering (the pool extending above Arnaudville) would be 138,600,000 cubic feet, which is equivalent to a deficiency of 3,000,000 cubic feet per day for 46 days. Before the lowering of such a pool, 3 feet navigation would be given as far up as a point about 5 miles from Port Barré. At this point the bottom of the bayou rises quite rapidly, constituting an effective barrier to prevent the pouring over of the accumulated supply into the Courtableau, which during low-water seasons would be at a lower level than that proposed for the pool. Should it be desired in future to establish navigable communication between the Courtableau and the Teche, artificial means for regulating the flow between the two streams would of course be resorted to. The bottom of the Courtableau at Port Barré is 23 feet lower than the bottom of the Teche one mile below Port Barré.

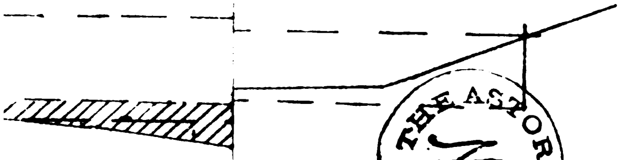
The facts above stated as to reach of navigation and supply of water attainable by lowering the pools, the locks being of 10 or 12 feet lift, are based upon the supposition that the normal low-water stage, above which the lifts are measured, gives a reading of 2.5 feet on the Saint Martinsville gauge. It will be noticed also that the pool is supposed to be closed by a water-tight dam, whether permanent or movable. The stored-up water supply as calculated seems more than sufficient, even with a 10-foot lock, for all demands that may be made upon it. It will be rare indeed that the natural flow during a period of thirty days would not exceed the needs of lockage, leakage, &c. But the surplus is not large enough to permit any laxity in regulating the consumption. Hence, although a movable dam is of course to be preferred, no variety can be considered which is not practically water-tight. The time of closing the lock, and whatever other openings might exist in connection with it, during high water would be determined by the needs of navigation in the upper part of the pool, where the inconvenience of low water is first felt. This necessity of looking to the upper part would secure the closing of the lock early enough to insure the filling of the pool before the natural flow became less than consumption. To illustrate this, suppose increased depth were needed at Arnaudville when the guage at Saint Martinsville reads 7 feet (this of course is an extreme case) the cross-sectional area would then be 600 square feet, the mean velocity about seventy-five one-hundredths foot per second, the daily discharge about 40,000,000 cubic feet. To fill up to 12.5 feet on the guage, that being the reference of the top of the dam with 10-foot lift, would require 150,000,000 cubic feet. This could be done in about four days with the surplus over lockage needs, the bayou supposed to be constantly discharging as much as when at the reading 7 feet. A similar calculation made for a 4-foot stage shows that about thirty days would be required to fill the pool with the surplus that would be constantly delivered at such stage. In practice it would usually be found that up-stream

eat height of such a dam as mentioned above, when considering it alone,
both costly and cumbersome. But I find that a combination of the two
ay be applied to the cross-section referred to before as taken from the sur-
2 in such manner as to avoid the great height of movable structure and yet
n undiminished water-way, the lock being open. The accompanying sketch
paper shows this cross-section and two arrangements of the dam. In the
ese there are 250 feet of movable dam 10 feet high, and 88 feet 6 feet high.
ond there are 194 feet of movable dam 12 feet high, and 88 feet 6 feet high.
he dam rises to 15 feet on the gauge and rests either on top of the low-sub-
rmanent dam, or on a floor laid in an excavation. In both, the areas sub-
lock-walls and permanent dams are practically equal to those added by ex-
so that when the lock-gates are open and the movable dam down the flood
same as in an unobstructed cross-section. In the second case the top of the
t dam is placed so low that, the water standing at 7 feet on the gauge, a boat
feet could pass over this dam. Vessels may, of course, pass through the
at high stages, since there would be no increase of current through it save
combing around the walls; but the wide water-way at its side would cer-
of great convenience as a passing place, especially if a considerable settle-
ıld grow up near the site of the lock. Estimating the permanent dam to be
rage thickness of 12 feet, there would be about 60 cubic yards of it in the
and 50 cubic yards in the second. In estimating the earth to be excavated
sary to consider not only the quantity the removal of which would permit
uction and manipulation of the movable dam in a sort of transverse ditch, but
tity removed in cutting down the sides of this ditch up and down stream.
the water would eddy in this ditch and the cross-section of the stream at
vould not be efficient for flood delivery as elsewhere.

the approaches to be begun at points 100 feet above and below the dam, and
e by removing the earth lying within the right lines drawn from all points
imeters of the areas of excavation, as shown on the cross-section plotted, to
of the bank on the same side with the area considered, and at a distance of
p or down stream. There would be four such pyramidal volumes, aggre-
out 3,000 cubic yards. Of this amount, however, a very large part, if not all,
rofitably used in constructing the necessary coffer-dams. The determina-
e proper relation that should exist between areas of excavation and of the
nd permanent parts of the dam must be delayed until the site of the lock
ly chosen and the form of cross-section accurately known. The relative cost
ent and movable dam per linear foot, and change in cost due to change in
movable dam, must also be known.

ch combination as the two suggested, of permanent and movable parts in
dam, will, I believe, best suit the needs of the case, under the supposition
ayou be made its own reservoir.

ins to be said concerning the water supply that the availability of Spanish
a source of supply has never yet been determined with exactness. But
report was begun I have made examinations of it sufficient to convince me
gh water may be had from it to supply deficiency in the Teche, and that it
d without large expenditure. Should this expenditure be equal to or even
exceed the difference between cost of dam and lock without, and the cost
a height for holding surplus water in the bayou itself, then this plan of
nish Lake would be preferable. As has been said, the high pools previously
l upon might cause inconvenience to many back yards, and might further
with the drainage system on many plantations. The area of Spanish Lake
ated by Assistant Engineer Collins at about 6 square miles. Hardee's offi-
of Louisiana makes it between 5 and 6; my own estimate was the same.
e area to be 5 square miles=139,392,000 square feet—or, we may say, that
ng the surface of the lake 1 foot we obtain 140,000,000 cubic feet of water=
ficiency of 2,000,000 cubic feet for seventy days supplied. The depth I
e irregular, as persons who have made chance soundings report from 6 to
I found no more than 6.5 feet out to a distance of about half a mile from
ng a line in prolongation of the line of the small canal leading to Bayou
ough Keystone plantation. Even if no greater, this depth is sufficient for
ses in view. I learn from Mr. Peters, in charge of the Keystone plantation,
ake varies its surface level about 2 feet between times of heavy rains and
lrought. When seen by me it was at about mean stage. This mean stage
6 feet above low water of the Teche, and in the ditch or canal now connect-
nd bayou this whole fall is effected over a distance of about half a mile,
whole of the first mile being at the level of the lake, the whole length
miles. The high water of 1882 met the lake water in this canal, and there
ically no fall; but suppose a pool be raised to 10 feet on the Saint Martins-
ge, giving 5 or 6 feet at Arnaudville, then there would be a fall or 8 or 10
lake to bayou. The nearly level part of the ditch referred to is about 8



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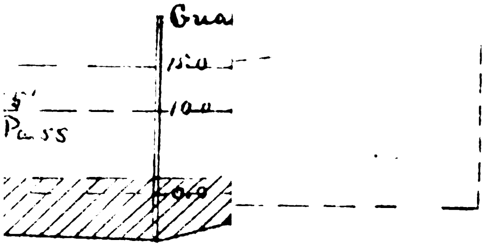

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been shown, in the case referred to. In the case now considered I give nder the supposition of a combination of permanent and movable dam:

o water-way by lock excavation	square feet	750
ted from water-way by permanent dam	do	730
vated for lock, 80 by 20 by 400 feet	cubic feet	640,000
vated, upper approach, 50 by 15 by 400 feet	do	300,000
vated, lower approach, 50 by 15 by 400 feet	do	300,000
vated for permanent dam, 200 by 3 by 20 feet	do	12,000
e excavated, total	do	1,252,000
vated, total	cubic yards	46,370
onry, lock-wall and bays, 15 by 6 by 800 feet	cubic feet	72,000
onry, floor and foundation, 80 by 5 by 400 feet	do	160,000
onry, permanent dam, 10 by 730 feet	do	7,300
onry, foundation dam, 200 by 2 by 20 feet	do	16,000
e masonry, total	do	255,000
onry, total	cubic yards	9,455
ovable dam	feet	95
ovable dam	do	9
rmanent dam, average	do	3.6
sheet-piling across bayou	do	260
, 260 feet by 3 inches by 6 feet=1		4,680
, in 12 inches by 12 inches grillage under lock-floor		234,000
asonry, at 140 pounds per cubic foot (concrete)	pounds	28,850,000
ckful of water	do	14,400,000
illage	do	585,000
tes and connecting iron	do	175,000
ovable dam and attachments	do	100,000
l	do	43,610,000
iles for foundation		700
l piles not assisted by earth	pounds	62,200
r-dam		500
cubic yards concrete, at $10		$94,550 00
0 feet cypress lumber, at $15 per M		3,600 00
iles driven, at $8 per pile, driven		5,600 00
0 cubic yards earth excavated, at 25 cents		11,592 00
t movable dam, at $100		9,500 00
sets gates, at $5,000		10,000 00
bolts, &c		1,000 00
eet coffer-dam, at $15		7,500 00
keeper's house		1,500 00
near lock		1,000 00
not above estimated in cost material		30,00 00
		148,842 00
ent. contingencies		29,768 40
		178,610 40

is estimate to that for the case of permanent dam throughout and on the side for increased water-way, we substract 95 feet movable 00. $9,500

d—

ards excavated, at 25 cents	1,852
ards masonry (concrete), at $10	5,880
	7,732

first estimate of $148,842 by $1,768, making it $147,074, practically the he excavation of 74.07 cubic yards earth is to gain about 1,000 square tion occupied by the movable dam, now replaced by permanent structg approach above them 200 feet long, and a slope below the dam 100 feet t an eddy otherwise to be expected in a sudden widening. This cut is high water, the upper end not being cut through the natural bank. The

the possibility of lower prices in several elements of the construction, but in eliminary study I give only what seems to me figures that will not disappoint oving too small. Thus it may be found that brick would be cheaper than con- in the construction of the lock-walls.

thousand brick will lay about 1.6 cubic yards of masonry, which will weigh t as much as an equal quantity of concrete, the bricks being best pressed quality. can be laid for $5 per thousand, and would now cost about $25 bought here and ered. A cubic yard would then cost about $18. I believe this figure might be red by having the bricks specially made at or near the site of the lock. Bricks ade all along the Teche, but, so far as I know, none of extra quality. It is fair sume that, since the proper soils are found near Saint Martinsville, bricks of de- quality might be made at less cost there than they could be had transported from ance. Ordinary *hard* brick, such as are used for pavements in this city, if bought would cost when laid at Saint Martinsville about $12.50 per cubic yard. Bought e country such brick would cost about $8 per cubic yard laid. But masonry of brick has less specific gravity than concrete. When dead weight is a considera- the cost of the structure would, therefore, be the same as, or greater, in brick in concrete. The cheapest construction would doubtless be of timber, so far as l cost is concerned. But the greater cost of repair and the shorter life of such k make it advisable to incur, then, greater initial cost of masonry. What has been of the lock masonry, is also true of that part of the permanent dam, not topped e movable—namely, that a change of material *may* result in an economy in the truction that the saving will not be great.

om the foregoing I draw these conclusions:

rst. Water enough to supply any deficiency in the bayou itself may be had from ish Lake.

cond. This water can be had at a cost of about $1,500.

ird. The best position for the lock is at a point about 14 miles below Saint Mar- ville, because, (*a*) all dredging is avoided; (*b*) a slight increase of possible draught tained.

urth. Part of the dam should be movable, because (*a*) a wide navigable pass is e available at high water; (*b*) it offers the best means of retaining the normal section at flood stages.

fth. A horizontal line drawn the 10-foot mark of the Saint Martinsville gauge is t higher than the bayou bottom at Arnaudville; hence the crest of the dam should ld at that height.

xth. The foot of the movable dam should be held at or near the zero of the Saint tinsville gauge, thus permitting uninterrrupted navigation when the gauge reads t. The water having its natural slope at this reading, 5 feet can be carried to udville.

venth. Lock and dam can be built for about $175,000, the masonry being wholly rgely of concrete.

ghth. This estimate of cost may be too large, but it is not too small.

inth. The estimates of dimensions may in many cases be reduced by more detailed y; they would rarely be increased.

nth. A lift-wall, rising to 4 feet on the gauge, can be built at the upper end of lock, thus diminishing cost of upper gates and cost of excavating upper approach.

had intended to include in this report some study of the general relations between cities in different parts of the cross-section of a stream. As these matters are not ssary to the discussion of plans for the lock, consideration of them will be pre- ted separately.

Very respectfully, your obedient servant,

O. T. CROSBY,
First Lieutenant, Engineers.

aj. W. H. HEUER,
Corps of Engineers, U. S. A.

R 6.

ONNECTING BAYOU TECHE WITH GRAND LAKE AT CHARENTON, LOUISIANA.

he project was adopted in 1880, the object being to connect Bayou he with Grand Lake at Charenton by a canal a little over a mile in th, 5 feet in depth, and 50 feet wide at bottom. Careful examina-

R 7.

IMPROVEMENT OF BAYOU BLACK, LOUISIANA.

nination of this bayou was ordered by act of Congress of June
0. Preliminary examination was made in January, 1881, and a
report made February 2, 1881, full report being prevented by the
of the employé who made the examination to submit report,
frequently directed to do so. On March 3, 1881, $10,000 was
riated for this work.

n the annual report of 1881 was published a full report of a pre-
ry examination made by an assistant engineer, in which the con-
of the bayou, as indicated below, was clearly represented. Ap-
tions made in 1882 and 1884 amount to $25,000.

n inspection of this bayou made in April, 1885, I made notes and
ations, and on them base the following report and deductions:

n the village of Tigerville to the spot where the dredge is at work,
10 miles above, the Bayou Black has now a depth of 5 to 6 feet
-water—the width of this water-way varies from 45 to 100 feet.
greater portion of this 10 miles has been worked over by the
, and the last 4 miles is practically a canal in the bed of the bayou,
has been dug by the dredge. As fast as the digging progresses
ch or canal which is being dug becomes filled with tide-water,
at portion of the bayou in front of dredge is so filled up with
nt, grass, logs, roots, and stumps, and contains so little water,
present it is impossible to float the lightest skiff.

n the examination was made in April, 1885, and resulted in a
ge of the work, principally because the appropriation was about
sted, I doubt if there was 50 gallons of water per minute flowing
bayou, and a few days before this the ground in front of the
was so hard that it became necessary to hire 4 mules and a
o break the ground so that the dredge could work.

act, following the rank, tall grass growing in the old bed of the
is the practical method of tracing its course.

n the point where the dredge has now stopped working to the
f Houma *via* the line of the bayou (the proposed improvement)
iles in length. The bed of the bayou is filled up with mud and
ctions very nearly to the level of the roads on each side of it; so
complete the work contemplated will yet practically require the
g of a canal 45 feet wide by 6 feet deep by almost 14 miles in

muck, &c., thrown out of the canal is so oozy or semi-fluid that
of it will run back into the canal, and it is probable that a pile
mber revetment may have to be built over a considerable portion
route to prevent this.

each bank of the bayou is a wagon-road 25 to 40 feet in width,
eyond which are the fences of plantations and small farms. The
must therefore be thrown on the road, obliterating that on one
erhaps on both, and making either of them for the time being al-
f not entirely impassable.

en the canal, or ditch, shall have been completed to Houma it will
small boats (probably flat-boats) to carry sugar and the material
cts of the country from the plantations bordering on the bayou
Tigerville to Houma, an extreme distance of about 24 or 25 miles.

estimate for completing this improvement, by Major Howell, in
as $47,520; of this amount nearly $25,000 has been expended,

private contractor, by order of the honorable the Secretary of War. as used on Red River, Louisiana, and rent received for same for 116½ s, at $20.00 per day—total, $2,330.00. This amount was credited to appropriation for Bayou Black, and permitted the repair of the dge.

The boat has been lying at Morgan City, La., since it was returned the contractor, December 2, 1885. Here the repairs have been made hired labor and purchase of material in open market. The dredge ow in fair order. All repairs have been made that are necessary to ble the dredge to be set to work.

Money statement.

r 1, 1885, amount available	$427 68
mber 5 and 12, 1885, amount received for rent of dredge-boat	2,330 00
	2,757 68
r 1, 1886, amount expended during fiscal year, exclusive of liabilities tstanding July 1, 1885	2,825 87
r 1, 1886, amount available	431 81
mount (estimated) required for completion of existing project	56,000 00
mount that can be profitably expended in fiscal year ending June 30, 1888	10,000 00

ubmitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

R 8.

IMPROVEMENT OF BAYOU COURTABLEAU, LOUISIANA.

he original project, made in 1879, contemplated (1) the closure of a nber of outlet bayous on the south, or right bank of the stream, for purpose of cutting away Little Devil Bar, near the mouth of the rtableau; (2) the construction of locks and dams, carrying slacker navigation to Port Barré (17 miles above the mouth) by the first and to Washington (28 miles above the mouth) afterward.

he estimated cost of the work was $40,000, afterward increased to ,500. Subsequent investigation as to the probable cost of lock-contction in this section of the country lead me to believe that even this ond estimate is too small.

s appropriations became available several dams were built across let bayous, and the result was a very marked deepening of the bar he mouth of the bayou, by as much as 3 feet in two days.

ne of these dams was afterwards reported cut by the swampers, h whose logging operations it may have interfered; the result was t in 1884, immediately after the dam was opened, the bar shoaled as h as 4 feet.

uring the fiscal year 1884–'85 a quarter-boat and flat-boat pile-driver e built for use on this bayou. High water prevented their use until gust, 1885. Work was then begun, following plans submitted by tain Turtle in a letter dated November 28, 1884, and containing exnation of conditions originally existing. (See report for last fiscal r.)

he construction of two dams was accomplished, one at Little Forhe, under Lieut. O. T. Crosby; and one at Big Fordoche, under

Superintendent O. D. Anderson. The construction of the for
interfered with by a sudden rise. The completion was hasten
the rise continuing, the dam gave way the day after it had been
complete. Work was resumed on it and continued until agai
water-tight. Large amounts of willow brush were placed betwe
of piles, and weighted with bags of earth, and loose earth when
rent had been sufficiently checked to permit its use. The sco
the current after the break permitted round piles to be driv
clay, which had before been almost impossible with the sawed
dered for conditions existing at Captain Turtle's examination.
that examination considerable shoaling had taken place, due
to the remains of old timber dams supposed to have been cut,
increased depth of sand rendered pile-driving very difficult.
boat-men, who have recently passed that point, report that wate
running over the dam, though, as was anticipated, the outle
has nearly filled up, and the bar which before lay just below th
Fordoche is now quite above it.

The dam at Big Fordoche was strongly built in clay founda
remains in position. Lumber was bought for the commencem
third dam, but funds having run too low for further work, t
and lumber were stored in December, 1885, since which time
has been done.

At the date of this report it is impossible to make an exa
of present condition of the dams and bar, since the water is ve
As it seems probable that important changes in the regime
Atchafalaya will soon be attempted, I do not now recommend
propriation for the Courtableau for the fiscal year 1887-'88.
propriation that may be made this year by the bill now pendi
perhaps be wisely expended in endeavoring to give immedia
following places already presented or modifications that may
gested by an examination, to be made as soon as possible.
mendations for future appropriations can be much more inte
made after this examination has been made and something d
known concerning the future of the Atchafalaya.

Money statement.

July 1, 1885, amount available..
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885..

July 1, 1886, amount available..
Amount appropriated by act approved August 5, 1886..........................

Amount available for fiscal year ending June 30, 1887........................

Amount (estimated) required for completion of existing project.........
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

R 9.

IMPROVEMENT OF BAYOU TERREBONNE, LOUISIANA.

No work has been done in this bayou during the past two year
to a lack of funds.

An examination of this stream was ordered by Congress in 1

ect for improvement was made in 1880 at an estimated cost of
00, of which about $15,000 was to be for dredging, the balance for
ving logs, clearing of trees, &c.

e commerce to be benefited by the improvement, principally sugar
molasses, was estimated at an annual valuation of $958,750. In
an appropriation of $10,000 was made; with this a dredge was
d, and work was commenced 23½ miles below Houma, La., working
tream. In March, 1881, $8,800 more was appropriated.

he hired dredge improved about 8½ miles of channel, and in 1881
ped work about 15 miles below Houma. The examination for im-
ring the bayou was made during high water, and was found to be
gether too small in amount, as during low water it was seen that
bayou was little more than a ditch. The estimates for improve-
nt were accordingly increased by Major Howell, the officer then in
rge, by $20,000. With part of the money available from money ap-
priated for this work and part from Bayou Black appropriation a
ge was built to continue this work. The Terrebonne appropri-
n paid $5,262.70 toward the building of the dredge. In August,
2, $7,000 more was appropriated for continuing this work, and in
tember, 1882, work with the new dredge was commenced and con-
ed to within 10½ miles of Houma, when the funds became nearly
austed, and further work had to stop.

o appropriations have since been made, and consequently no further
k has been done. The channel was originally dredged to a depth
feet, but nearly every plantation on the bayou has ditches draining
it; these cause deposits in the bayou, and opposite these numer-
ditches it has again shoaled up until the depth is only about 4.8
t.

ne or two very small steamboats run up to Houma when there is
business for them, and the project was to carry the improvement
to Houma, there connect with an old abandoned canal, about a mile
g, now dry, with wagon-roads crossing each end of it, which canal
merly connected with the Bayou Black. Should this and the Bayou
ck work ever reach the opposite ends of this short canal, which was
ut 33 feet wide, then it was hoped this would be deepened, and
ble the tides to flow regularly through both bayous and the canal,
d maintain by its flow a better depth of water by preventing the
id growth and accumulation of grass and vegetable matter.

Should any further appropriation be made the work of dredging will
continued toward Houma. It is thought the work can be completed
this place for the $13,000 estimated for in 1881-'82. If this improve-
nt, and that of Bayou Black in connection therewith, be completed,
y will be reasonably permanent and of some local benefit to this
tion of the State of Louisiana.

The commercial value of the products raised on the Bayou Terre-
nne is estimated, when the crops are good, at a little less than
,000,000 per year, and it was reported prior to a year ago that the im-
ovement had occasioned competition and a reduction of freight rates
this locality of about 25 per cent.

Money statement.

ount appropriated by act approved August 5, 1886	$10,000 00
Amount (estimated) required for completion of existing project	3,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	3,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

**e improvement of the navigation of the bayou, that by means of
k at Donaldsonville, and dredging out the bayou below where re-
ed, so as to make a tide-water canal of the bayou, having a channel 5
deep by 75 feet wide, estimated to cost $450,000, is very decidedly
ferable to any or all of the others.**

**n an engineering point of view, this plan is perfectly feasible, and the
mates are believed to be reasonable.**

**he estimated cost of making the improvement is $450,000, with an
ual estimated expenditure of $8,000 for operation and maintenance.**

interest on $150,000, at 5 per cent., is	$22,500
the cost of maintenance	8,000

**'e have in round numbers the equivalent of an annual Government
ense of, say, $30,000 to keep the Bayou La Fourche navigable.**

**ieutenant Crosby has shown in his report that the amounts paid last
r for freights to move the crops on the La Fourche were approximately
0,000; that for the three or four months that the bayou was low, the
eased cost of freight in consequence of having to handle it in flat-
ts was $19,000.**

**would be absurd to claim that the cost of transportation would be
less in consequence of a lock at Donaldsonville than it is at present
n ordinary navigable condition of the bayou, which obtains, say, dur-
eight months of the year; therefore if the lock and slackwater navi-
ion is to produce any decline in freight rates, it must be during the
-water season when ordinary steamers could not run. The additional
ght cost in consequence of low water during the present year has
n estimated at $19,000. Under these circumstances the Government
ld not be warranted in expending $30,000 per year for the sake of
ing $19,000.**

**he commerce of the bayou is estimated to have a value of little more
n $3,000,000 per year. The improvement will cost $450,000 to com-
e, and $8,000 per year to operate and miantain. Should the project
dopted by Congress, the entire appropriation should be made at once,
use dredging and construction of lock should proceed simultane-
y. The lock without the dredged channel would be useless, and a
lged channel without the lock would soon refill.**

Money statement.

1, 1885, amount available	$1,244 55
1, 1886, amount expended during fiscal year, exclusive of liabilities tstanding July 1, 1885	989 94
1, 1886, amount available	254 61

REPORT OF LIEUTENANT O. T. CROSBY, CORPS OF ENGINEERS.

OFFICE UNITED STATES ENGINEER,
New Orleans, La., June 11, 1886.

**: I have the honor to report as follows upon the work of running an accurate
of levels down Bayou La Fourche, Louisiana:**

**obedience to orders from you, I went to Donaldsonville, La., the point where the
'ourche leaves the Mississippi, on April 26, 1886.**

**e party, as organized here, consisted of 8 men, viz, Lieut. O. T. Crosby and United
s Assistant Engineer T. L. Raymond, observers; 2 rodmen; 2 helpers; 1 boat-
; 1 cook. We were quartered in a small hired boat, which was floated down
m to the end of the line, and towed up stream, on completion of the work, to
land, where it was delivered to its owner.**

below Donaldsonville and 25 above the mouth of the La
also the terminus of the line run in 1883, whose inaccura
made necessary the work just done.

Along this line a total of 191 bench-marks had been le
per mile. Of these we identified and corrected about 150,
mile. This made it unnecessary to repeat the hydrograp
carefully done, since any point in any cross-section of t
might be of value in making a plan of improvement can
corrected bench-mark. The whole error in the old line is a
ularly increasing error from beginning to end of the 64 mile
hundredth of this error would be introduced in referring a
bench-mark one-fourth of a mile distant (the average ir
bench-marks being about half a mile), this error must lie far
of error in hydrography. Had hydrographic work been at
been done at the present high stage of the river with hal
1883, when work was done at low-water stage.

The method adopted in leveling was as follows: Each ob
fore sight two or more times, the rodman calling out tl
peated until a satisfactory mean of several observations,
by only a few thousandths, was obtained. The rodmen rem
ing their rods on the same peg, until both observers had
tions of the difference-level between the two pegs, had c
tions and found that they closely agreed. In case they diff
repeated, instruments adjusted, observations again repeate
ment was obtained. This method places a severe check up
errors, both personal and instrumental. It saves time, ina
ered by it may be corrected before leaving the spot whe
time it of course saves money. It tends to prevent that
forcing of results which sometimes occurs when the correcti
to be a fatiguing, lengthy process. During the progress o
graduation of level-tube scale was discovered. The scale
bar, placed above the glass tube of the bubble, and is ma
bar. In this marking a double error exists: First, on both
the same numbered value, counting from the center of gr
sides of that point, are found at unequal distances from it;
are not the same on opposite sides of the bar. The first er
the same on both sides the bar would be eliminated when bac
no matter which side of the bar be observed in leveling. N
sides, it became necessary to observe the same side in level
sight. A discrepancy of about 0.2 foot between Mr. Raymo

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With this report I respectfully submit a profile of the bottom of the bayou and top east levee, together with all high and low water marks obtained, and all corrected nch-marks, this profile plotted to same horizontal scale as the topographic work, d on same sheets; also another profile of bottom and levee-top, on smaller scale and a single sheet, with typical cross-sections. The plotting was done by Mr. Ray- ond, the fidelity and intelligence of whose service both in the field and in the office ou are already so familiar with that special mention of them here is unnecessary. oth in the obtainment of data and in the preparation of the report his assistance s been of the greatest value.

The commercial interests to be affected by an improvement of Bayou La Fourche will understood from the following statements. The total value of agricultural products ised along the banks of the La Fourche during the season 1885–'86 was about ,200,000, of which about $2,900,000 must be ascribed to sugar and molasses, the re- inder to rice, potatoes, and miscellaneous products. It may be stated with suffi- nt accuracy, that the Southern Pacific Railroad Company controls shipments of ducts from the parish of La Fourche; this parish produced crops of the value of out $1,100,000, leaving $2,100,000 for the parishes Assumption and Ascension. The lroad freight rates do not vary with the stage of the water, since at all seasons ight transported by rail is gathered from the plantations by large flat-boats, the nning of which is rarely, if ever, interfered with by low water.

When the water in the bayou has reached a stage so low as to prevent the entrance large steamboats from New Orleans, products seeking shipment from the upper part the bayou are taken by flat-boat to Donaldsonville, thence by steamboat or Texas d Pacific Railroad to New Orleans. Captain Drown, secretary of the company nning the largest steamboat interest in the bayou, informs me that this flat-boat rvice causes an average increase of about 40 per cent. over high-water rates. The linary (or high-water) rates are: one hogshead sugar, $1.50; one barrel sugar, 35 nts; one barrel molasses, 75 cents; one sack rice, 25 cents.

The $2,100,000 given above for the upper La Fourche represent about 30,000 hogs- ads sugar, 70,000 barrels molasses, 30,000 sacks rough rice. On these goods freight above rates would be $90,000. From figures furnished by Captain Drown, I find at about 9,100 hogsheads of sugar, 17,000 barrels of sugar, 26,000 barrels of molasses, ,000 sacks of rice must have paid the 40 per cent. increase, thus making the freight ll of the upper La Fourche for outgoing products $109,000 instead of $90,000.

This excess of $19,000, capitalized at 5 per cent., represents $380,000. No other fig- es of definite value can be presented as showing the benefit derivable from an im- ovement that would permit through navigation all the year round. In addition this should always be accounted the value a free water-way always has in check- g monopoly prices. Whether such value in this case be large or small, I do not nture to guess, since it is a matter dependent upon the disposition of the Southern cific management. Just now the people along the lower as well as the upper part the bayou are enjoying the benefit of a very lively competition between steam- ats, resulting in a cut-down to one-quarter of railroad card rates. This has con- nued for some weeks, but it is not thought that it can continue long. The trips of e largest boats are now at times extended as far as Harang's Canal, 68 miles below naldsonville, while usually they go no further than La Fourche Crossing, 38 miles low Donaldsville. Some of those with whom I conversed claimed that the steam- ats would be able to conduct a much more beneficial competition with the railroad, re it not for the two or three months' interruption during low water, an interruption hich usually occurs when the sugar crop is beginning to move and transportation rangements for the whole crop may be made.

These statements relative to competition with the railroad apply only to that part the bayou below Napoleonville, a point 16 miles below Donaldsonville. Above that oint, low-water improvement, besides giving relief from the flat-boat charges, might tend competition among steamboats, as against each other. From Mr. H. O. Maher, harf-master at Donaldsonville, I obtained the following statement:

"When the Bayou La Fourche is navigable from December until about the first of ugust, the steamers Assumption, Isabel, E. W. Fuller, and Alice LeBlanc make two ips a week (each) to Thibodeaux and La Fourche Crossing, sometimes extending their ips as far as Lockport. The steamer Hélène is now making trips on alternate days etween this place (Donaldsonville) and Thibodeaux, frequently extending her trips Lockport, or even further. She is a passenger boat." There are four railroad sta- ons on Bayou La Fourche, one at Donaldsonville, one at Thibodeaux—the terminus a 3-mile branch line from Terrebonne Station; one at La Fourche Crossing, and one Raceland. The first, that of the Texas and Pacific, seems, from its position at the up- r extremity of the bayou, to be but little considered as a competitor with the steam- oats. The other three, belonging to the Southern Pacific system, having advantage position (34, 38, and 49 miles from Donaldsonville, respectively), and having acces- ry flat-boat lines constantly running, commands a large trade. I was informed that en the flat-boat service on the upper bayou must be suspended and wagons resorted xplanation usually offered to account for the necessity of constantly raising the ees in the lower part of the bayou." This common theory, as stated by them, was t, where the levee terminated, the waters of the bayou overflowed the banks and ed them by deposit. The current of the bayou being diminished by this escape water, a deposit was also made in its channel. This deposit contracted the water- y and increased the lateral overflow, and thus accelerated the elevation of the nat- l bank. This has had the effect of backing up the bayou above and thus raising flood level.

nstead of this explanation, they advance the theory that the constant rise of d level is due (1) to the fact that the lower bayou having had, before the build- of the levees, a cross-section large enough for carrying only the income at Don- sonville *minus* the lateral overflow permitted by low, natural banks, is now too small arry freely, without temporary damming up of a part, the whole amount enter- from the Mississippi; and (2) to the fact that the extension of the levees caused mporary increase of flood heights for certain distances above the point where ex- sion begins, the local slope being, of course, much diminished by such extension l height thereby increased. That the first of these causes would produce, at points ewhat distant from the Mississippi, immediate increase of flood height consequent n the first building of levees, need not be doubted. But Humphreys and Abbot state that "levees were commenced at an early day, and were extended rapidly wn one-half the length of the bayou." "In 1842 the levees terminated at or a le below Lockport, 56 miles below Donaldsonville, and 54 miles above the Gulf. 1859 they nominally extended 27 miles below Lockport, although it is stated they re not more than 3 feet high, 12 miles below that town." It has already been seen t they are effective now only as far as the cut-off, about fifteen miles below Lock- t. How, then, could the second cause operate, when there has been practically extension of levees; and to what shall we attribute the large increase of levee vation, shown to have taken place at Harang's, and to what shall we attribute "the essity of *almost* annually raising their levees," a necessity complained of gener- y by the planters near to and above Raceland, as reported to Major Howell? (See ief Eng. Rep., 1874, Vol. I, p. 767.) Evidently the first cause could not produce onstant increase of flood height, observable through many years succeeding the ablishment of the levee system; evidently, also, the second cause has been in op- tion only to an insignificant extent. Some other cause must have operated to pro- ce the increased flood heights. In Major Howell's report, above referred to, it is ted that the planters claim that the gradual filling in of the bayou between Race- d and the cut-off produced the increase.

his is substantially a repetition of the "usually offered explanation" referred to Humphreys and Abbot, the placing of the lower limits, the cut-off being in all bability due to the fact that all could see the growth of the great longitudinal s near that point (and which now appear as islands, even at high water), while few k account of the shoaling below, which still left ample depth for navigation. at some obstruction other than smallness of natural cross-section existed below ckport is noted by Humphreys and Abbot in a foot-note, page 455: "It has also n suggested as an additional cause of the rising of the high-water level that the you below Lockport is chocked up by rafts and tow-heads. * * * Lieut. Henry Smith, Corps of Engineers, who examined the obstructions below Lockport in 3 with a view to their removal, states that they begin about 5 miles below Lock- t, and consist of a great number of snags, which project above low water, and for distance of 18 miles almost entirely prevent the passage of steamboats during the water of summer and autumn. Such obstructions must, of course, retard the w of the water and to some slight extent raise the flood-level for a limited distance ove them, but they are evidently inadequate to aid materially in producing the stant increase of floods throughout nearly the whole bayou."

ll the snags appearing above low water have been removed during the last few rs by parties working under the direction of this office, but many remain imbedded der the deposit, the local growth of which was hastened by the presence of the s. The current maintains a channel on either side of these islands, but their pres- e largely diminishes the cross-section.

he facts above, showing clearly an annually progressive decrease of cross-section the lower bayou, were not known to, and were disputed, by Humphreys and Abbot. e knowledge of them leads inevitably to the conclusion that the theory presented Humphreys and Abbot, is unsatisfactory, and must be supplemented by the sually offered explanation," this itself to be supplemented by some emphasis upon fact that the shoaling begins at the very mouth of the bayou.

he eminence of the authority stating that "neither excavation nor deposit has n made in the bed," and the importance of the matter in considering a plan for manent improvement, made it necessary for me to go to some length on this point.

eeing now that a considerable portion of the sediment received by the bayou is osited at its mouth, in the Gulf; along its overflowed banks, and on its bottom

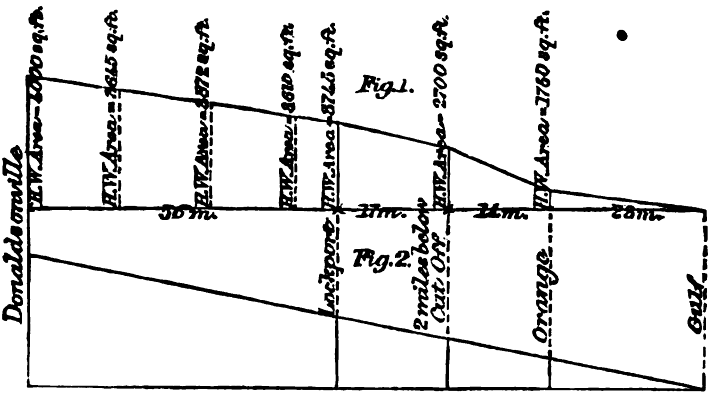

Fig. 1.

Fig. 2.

of the waters that no longer find sufficient cross-section for easy flow. This raising lood-height would be equivalent to a decrease of slope and velocity in the section ›ve. This would finally produce some deposit above; but, on the other hand, since total head between Donaldsonville and the Gulf is constant (approximately so), rease of velocity in an upper must be accompanied by increase of velocity in the er section. Hence deposit then would cease, or perhaps excavation occur, until al uniformity of slope would again be approached, only to yield again to another inge, these oscillations continuing until such size and form of cross-section had n reached as would cause annual excavations to equal annual deposits in the bed, whole mass of earthy matter then being deposited in the Gulf producing extenn of the delta formation. A slow decrease of average slope per mile would result, appreciable effects of which, however, are so distant that we need not now coner them. The sediment annually discharged into the La Fourche would cover one are mile to a thickness of about 1 foot. A few miles beyond the mouth of the Fourche the Gulf has a depth of 300 feet. The bar in front of the two mouths is sevl miles long; hence no rapid growth into the Gulf need be feared. Again referring the figures it is seen that in the second section, between Orange and the "cut-off," tension of levees would produce diminished slope. As the high-water velocity here now very great, it is not probable that the decrease would result in any material ange of the bed. The velocity would still be equal to that now existing in many aces without causing deposit. In the next section above—that between Lockport d the cut-off—the velocity would remain as it is, very nearly, but the flood-heights uld be considerably diminished. Above Lockport there would be an increase of locity, and a general decrease of flood-heights. It has been shown before that dredg- g throughout this section, without changing conditions along the lower sections, uld be soon followed by a re-establishment of present conditions throughout. But, ving secured an increased velocity, it follows that this restitution could not so adily occur. In the existing state the current is such as to leave the bed of the you almost unchanged from year to year. The dredged channel might then be aintained until modification of the immediate gain of velocity due to the changes tlined in discussing the lower or Gulf section of the bayou—this modification due disturbances originating at the Gulf—would be slow in reaching as far up as iibodeaux. Thus in the Mississippi, while we see rapid changes of bed near its outh, traceable to changes at and beyond the mouths, and changes at the Forts and ove that are traceable to local causes. There is doubtless a slow change throughout e river, due to changes at the Gulf, but it is not appreciable. Deterioration of the edged channel in the La Fourche would then be looked for as due to local causes. nce there is practically no caving of the banks these changes would be few as compar- to the number in the Mississippi, and would be due to slight, perhaps only temporary, regularities of cross section, which would operate to build up and remove changing rs. Therefore, while it is not probable that the great shoals now extending for iles throughout this section would reappear, it is probable that here and there a r would be formed, impeding navigation. These might be removed by dredging or the construction of wing-dams, as experience might direct. The Donaldsonville r would certainly recur, as the plan considered would have no appreciable effect ere. That bar is caused by the existence of a body of nearly dead water on both les of the line dividing the current of the Mississippi from that of the Lafourche. In any plan which would give security against recurrence of all other bars save annual expense of running them would doubtless be $25,000 or $30,000. Were y secured against floods, however, I believe many of these people would be glad abandon rice, or in this security against floods would consider themselves com-sated for the increased expense, if rice culture were continued. There is a con-gent benefit derivable from this plan in this, that it would facilitate the endeavor open any of the several canals that have been built up to the La Fourche levees, but nection never made on account of the expense of locks. At Lockport, the ter-nus of company's canal, a lock was built, and afterwards destroyed by a crevasse. was never opened. Harang's Canal has never been opened. The State "cut-off" s never been opened. All these would furnish most desirable lateral communica-n with New Orleans. They are not large enough to carry steamboats such as those w trading on the Upper La Fourche, but a considerable part of the potato and it crop is now handled by luggers, which have a circuitous route, inside or out-e. It was confidently stated to me that private enterprise would certainly open se canals, or one of them, if the cost of lock construction were reduced to a very all sum, as it would be by this improvement.

Fourth plan.—By adding to that just considered, a movable dam, placed at the side the lock.

This is, of course, feasible, and as there would be but 50 or 60 feet of such movable rt it would not be a costly work. It would, however, require one complete side-ll to be built for the lock, which would materially increase the cost of that struct-e.

t would require a much larger amount of dredging, and, without constant and costly gulation, might subject the less prudent inhabitants to the danger of overflow, ce even the restricted discharge of the Mississippi might raise the water surface up or above the level of the lower lands. It would cause the admission of floating s, which would become obstructions. The advantage gained would be the relief m the necessity of locking during three or four months of each year. The initial t would exceed that of the other plan by not less than $60,000. The annual cost maintaining the dredged channel would be very much increased, since a much larger ount of sediment would be introduced. Near the lock a dangerously strong cur-t would be produced. Of the two plans, the former is, in my opinion, preferable.

Fifth plan.—By placing a lock or dam at Donaldsonville, and one at Lockport, and roducing water in the basin thus formed from Lake Field, lying 1 mile west of Lock-rt. This plan is referred to simply because it has been discussed by engineers of repu-ion in the State. The discussion, however, is based upon the erroneous reports of ne persons (private surveyors, I believe), to the effect that the water in a small canal t from the lake toward the bayou, stands 7 feet above low water of the bayou. This ce is a drain for swamps west of the La Fourche. At the time of the survey of 1883 water was about 2 feet above mean low tide of the Gulf, and, from information ob-ned by a recent personal examination of the lake, I learn that this elevation was not obably its lowest water. Its level is subject to rapid variations due to rains, but ring low-water season of the La Fourche is usually about as low as that stream. e plan is, therefore, not worthy of further consideration.

Sixth plan.—By purchasing and completing company's canal. This canal is cut m a point opposite the upper part of this city to Lake Salvador, east shore; from st shore of Lake Salvader to Bayou La Fourche, at Lockport. The lock at the Mis-sippi is in use; that at Lockport is in ruins. In order to accommodate boats ch as are now in the La Fourche trade, both locks, and the whole length of the canal, out 8 miles, would require enlargement, at very great expense. The locks would actically be rebuilt. The upper (most valuable) part of the bayou would be little nefited without dredging. The effect of dredging, without construction of a lock at naldsonville, has already been studied. With a lock at Donaldsonville, the other es become only a convenience, not a necessity. As a convenience, replacement of e small lock at Lockport might be a paying investment, as before stated, while to rchase and enlarge would be entirely too expensive.

Seventh plan.—To construct wing-dams throughout the shoal region. As an adjunct the plan of dredging and levee building, these constructions have already been re-red to. To construct as many of them as would be required for producing navi-ble depth throughout the many miles of shoals would be a very expensive work; a stream whose low-water width is but 80 or 90 feet, it would be, if not impracti-ble, certainly dangerous; it would only hasten deterioration in the lower bayou; it ght require expensive dredging in the beginning; without levee building its effect uld probably be only temporary, as shown in discussing the first plan; it has not incidental advantage of securing against floods, or of adding to the cultivable a.

Of these seven plans, I believe that of converting the bayou into a salt-water canal nected with the Mississippi by a lock is the best, and that it would pay an im-inary private owner of the whole La Fourche country to execute it.

R 12.

IMPROVEMENT OF CALCASIEU PASS, LOUISIANA.

In 1874 a channel was dredged through the bar or flats at head of Calcasieu Pass. This cut refilled, and in 1881–'82 was again dredged hrough for a distance of 7,500 feet; a channel was made 8 feet in depth and 70 feet in width. This work was done by contract, at a cost of $10,444.

The total appropriations for this work to date have aggregated $30,000, of which $27,074.75 have been expended on the improvement.

The latest information from this locality indicates that the dredged channel over the bar has again refilled to its normal condition before dredging, viz, 3½ feet of depth.

Both channels which were dredged over this bar were cut across the shortest line of the bar, were to a certain extent experimental, and urged by commercial and navigation interests, so as to get immediate results. Since these cuts refilled so rapidly, a cause for this deterioration has been sought for, and it is believed to be partially due to the waves and currents passing between the lake and the pass not acting in the line of the cut, and also due to the small number of steamers using the cut. As the directions of the seas and currents are to a great extent governed by the winds, and these are variable both as to direction and intensity, no channel can be excavated on the bar which shall at all times have the currents and seas flowing in its axis, and therefore be subjected to some fill; but it is thought that, if a cut be made across the flats more nearly in the direction of the prolongation of the axis at the head of the pass than the old cut was, the filling would be less rapid than formerly.

This improvement is now in an unfortunate condition, owing to the wording of the act making appropriation. Heretofore this bar has been dredged upon from the appropriation for "improving Calcasieu Pass," which was clearly applicable to this work, but two later appropriations were made for improving "Calcasieu River," without specifying any particular locality for improvement, and it is not known that appropriations for improving the river can be properly applied to the improvement of the pass. It is certain that the improvement of the river proper is of no use so long as the present bar obstructs navigation at the pass. Should it be decided that money for the river can be applied to the bar at the pass, then work could go right ahead, as the money available for the river, together with that for the pass, would enable an effective channel to be cut at the pass, and any balance could then be used for whatever might be required in the way of improvement higher up-stream. But to spend public money for improvement up this river with the bar at the pass unimproved would be a waste of public funds. As the funds certainly available for the pass are not sufficient to do any work there, no work has been done on either the pass or the river during the past fiscal year.

If it be decided that funds for the river can be used for the pass, or if further appropriation be made for the pass, then a careful examination will have to be made as to which line the proposed cut shall be made upon. It is thought the cut will cost about $16,500.

The commerce of the pass is entirely dependent upon that of the river, and the latter is estimated to have an annual value of $528,000.

Money statement.

July 1, 1885, amount available	$2,925 52
July 1, 1886, amount available	2,925 25

There is no commerce worth mentioning at Sabine Pass; it is pros-ective, and depends upon the results of the contemplated improvement. The work has been in local charge of Assistant Engineer Thomas L. ymond, who has done all his work in a most thorough and satisfac-ry manner, and who has furnished the following detailed data of work ne during the year.

At the close of the last fiscal year, the construction of the two jetties der contract with the Louisiana Jetty and Lightering Company was ll in progress, and in the annual report then submitted a detailed ac-unt of the character of the work and the methods employed was given, ere having been built during 1885 to July 1st of that year 10,200 linear et of the foundation of east jetty, 8,700 feet of which had been built up high tide by the addition, where necessary, of top mattresses 15 feet ide; on the west jetty there had been placed during the same period 00 feet of mattresses 10 feet wide.

From July 1, 1885, to the close of the contract on August 26, 1885, e foundation of east jetty, 40 feet wide, was extended 990 feet, and e top work, 15 feet wide, was carried to a point 350 feet from the end the foundation, or a distance of 2,140 feet beyond its terminus on ly 1, 1885.

The west jetty, during the same time, was raised above high tide r a length of 5,710 feet, and to mean low tide for a distance of 562 feet yond the former work, being 15 feet wide and the latter 20 feet wide.

To sum up: At the the close of the contracts of 1885 the east jetty ndation was 11,190 feet long, and nearly up to mean high tide for a stance of 10,840 feet, in the construction of which there had been used 90$\frac{157}{234}$ tons of stone, and 664,364 cubic yards of brush. The west ty foundation, built in 1883, was 16,074 feet long, 6,710 feet from the ore, having been raised to mean high tide. In 1883 there were used this jetty 14,465 tons of stone, and 104,088 cubic yards of brush, and 1885 there were used 2,386 tons of stone and 11,353 cubic yards of ush.

SURVEYS.

Three surveys, previously reported upon, have been made during the st fiscal year; the first in September, 1885, the second in January, 86, and the third June 23 and 24, 1886; a chart of the last is here-ith submitted.

These surveys show a continuous improvement in the depth since the nstruction of the east jetty, resulting in the present channel of 8 feet pth at mean low tide across the bar, which assures a navigable depth 9 feet into the pass at the ordinary daily high tides. Appended to e chart is a comparative profile of the present channel and that ex-ing at the time of the inauguration of the present work of improve-ent. This profile shows an increase in depth since 1881 of 4 feet near e beginning of west jetty, the gain diminishing to 2¼ feet opposite e end of east jetty, while as far as 2,500 feet beyond that point the crease in depth is 1 foot.

A comparison of contours of equal depths shows the following im-ovement:

The 6-foot contour, through which there was in 1881 a channel 550 et wide and 6.1 feet deep, has been obliterated between the jetties and eir prolongations 2,300 feet wide.

The 7-foot contours, 3,000 feet apart in 1881, have also disappeared tween the jetties and over the bar.

Money statement.

y 1, 1885, amount available	$107,902 46
y 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	105,256 10
y 1, 1886, amount available	2,646 36
ount appropriated by act approved August 5, 1886	198,750 00
ount available for fiscal year ending June 30, 1887	201,396 36
mount (estimated) required for completion of existing project	2,301,250 00
mount that can be profitably expended in fiscal year ending June 30, 1888	1,000,000 00
ubmitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

NDITION OF THE WORK AT SABINE PASS, TEXAS, IN AUGUST, 1885.

OFFICE UNITED STATES ENGINEER,
New Orleans, La., September 24, 1885.

ENERAL: I forward herewith a report of Mr. T. L. Raymond, assist-
t engineer, on the condition of the work at Sabine Pass, Texas, at its
mpletion late in August, and a tracing* in a separate package by
il to illustrate the report and to show the changes which have occurred
consequence of the jetties, as well as the present condition of the
annel.

The results thus far obtained are even more favorable than were ex-
cted at this stage of the work. The channel between the jetties has
aterially improved by scour, proving beyond a doubt that the jetties
ien completed will do what has been claimed for them, produce and
aintain a deep-water channel. On the *outside* of both jetties the water
shoaling. This adds materially to the strength of the jetties, and the
sters are growing so rapidly on both jetties that before many years
th jetties are likely to have the appearance of oyster reefs.

While deeper water is being obtained between the jetties, it is not
ing obtained for any considerable distance beyond their outer ends.
is probable that much of the material scoured from between them is
opped just beyond, where the currents again weaken. In other words,
e bar is being pushed seawards. But the advance of the bar seaward
very much slower than is the advance of the jetties, provided there
money to build them with. Our appropriation is now so nearly ex-
austed that work had to stop. Scouring will probably continue be-
een the jetties and shoaling may occur beyond. If funds were avail-
le so that the work of jetty building could be continuous, the jetties
ould soon be beyond the crest of the bar. The deposit would continue,
it would be in deeper water, where the littoral current known to exist
ould probably be effective in aiding its removal. In a little more than
e months about $200,000 worth of effective jetty work has been done.
early all of this was done on one jetty (the east jetty). Eleven thou-
nd one hundred and ninety feet, a little over 2 miles, was built in
is time, thus proving that nearly $500,000 worth of work might have
en done in a year on one jetty if the money had been available; and
there are two jetties to be built, work, to be the most effective and

---

* Tracing omitted.

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of the work was done, were from 1 foot to 1¼ feet greater. The approximate ıity of the settlement of the whole jetty, the construction of which extended 'e months, seems to indicate that the greater part of this subsidence takes place the first month after construction, though it cannot be hoped that work of this :er, built principally of brush compressed by lever-power, will cease to compact or several years. Much of the settlement, too, is doubtless due to sinking into tom, but the amount of this cannot be well ascertained independently of the ssion.

ə have been used in the construction of the east jetty to date 66,436.4 cubic f brush.

ıst.—In the use of stone, the more expensive material of the construction, the ɔf the top work, which is subject to the greatest exposure to wave action, was vered, while the foundation-mattresses were loaded with only such quantities e as would insure their safety from displacement during the short time which ned before the top course was placed upon them. Thus while the proportions e to brush varied slightly in individual cases, the average for the whole of the tion-course shows the proportion of 1 ton of stone to 12.1 cubic yards of brush, the top work 1 ton of stone to 3.8 cubic yards of brush.

idering the jetty as a whole, the proportion stands 1 ton of stone to 7.5 cubic ıf brush.

'otal amount of stone placed upon east jetty is 8,890$\frac{157}{224}$ tons.

WEST JETTY.

ıg to the settlement of that portion of the west jetty, which, in 1883, had been › mean high-tide level for a distance of 6,146 feet from shore, it was deemed ble to prevent the escape of water over it to about the same distance from shore east jetty had been carried, and the work of raising this jetty above mean de was begun June 26, 1885. At the close of the contract this had been accom- for a length of 6,710 feet from the shore, and 562 feet beyond this a second l been placed upon the old foundation, raising this part of the jetty one-half ove mean low tide.

new work begins 180 feet seaward of the old shore end, owing to the advance shore-line that distance along the jetty.

vidth of the new work for a length of 1,800 feet nearest the shore is only 10 e shoalness of the water on both sides serving to render this light work secure. 'emaining 4,910 feet of the top work is 15 feet wide. At a point 2,000 feet from where the depth of water over the old jetty was found to be 3 feet at mean low 'o mattresses 20 feet wide and 2¼ feet high were first sunk before laying the top When the end of the old top course was reached, 1,100 feet of these 20-feet ısses were put in, carrying this work 7,272 feet from shore, and all but 562 feet was covered by top mattresses.

ıverage height of the new work is 3¼ feet, except where the two tiers above ıed were used, and there the height averages 4¼ feet. The elevation of the top etty, as far as completed, now averages 1¼ feet above mean high tide.

:otals of material used upon the west jetty this year amount to 11,353.2 cubic f brush, loaded with 2,386 tons of stone, which give the proportion of 1 ton of › 4.7 cubic yards of brush. All the top work upon this jetty was built in place, ıg a good opportunity of ascertaining the condition of the work done two years There seems to have been no loss, except from settlement, and measurements ıat nearly all of this subsidence took place during the first six months after struction. The growth of oysters upon the brush and stone has greatly added ›lidity and strength. The test mattress, loaded entirely with oyster shells was o be intact, and its elevation fully up to that of the remainder of the work.

RESULTS.

:hart herewith submitted gives the results of the survey made immediately upon ıpletion of the contract, showing a comparison of the soundings then taken ıose taken in 1881 before any work had been done, longitudinal sections of the ties, and a comparative profile of the bottom along the line of the deepest water. rally considered, there has been a deepening since 1881 of from 1 to 2¼ feet over ole area between the jetties, the greatest scour having taken place in the deep- er. The improvement in depth has extended for a distance of 2,000 feet beyond l of the east jetty, though to a less degree than within. Beyond this there is a rea where no change has occurred, while beyond this again there has been a g of four-tenths of a foot in the line of the channel and out to a depth of 12 feet shoaling which extends out to the 12-foot depth. The decrease in depth is ıt near the jetty, and diminishes gradually toward the eastward. The bottom ıis area is hard sand, and it is evident that the shoaling has been due to the g up of the westerly sand-drift against the west jetty; for in 1884 this sand was found to extend 1¼ miles to the eastward of the west jetty, while now only found in isolated spots farther to the eastward than 1,800 feet from the

distance between 8 feet depth inside and outside has dir
1881 to 4,600 feet in 1885, the outside curve having recede
amounting to 3,200 feet.

The 9-foot curve has advanced seaward between the je
outside curve has also advanced 400 feet, leaving a net gai
the two of 1,450 feet.

While the advance of the outside curves is unmistakable
to shoal beyond the work now completed to mean high-
this shoaling is as yet small compared with the scour. The
carried beyond the original bar, and the foundation of the
yond the end of the east jetty, checks the easterly as wel
rents, causing deposits on either side of it.

With the comparatively feeble currents of the summer m
gain in depth for a distance of 2,000 feet beyond the last top
measured along the channel line, and the improvement is
entrance for a distance of 1,000 feet beyond the end of the

Respectfully submitted.

Maj. W. H. HEUER,
Corps of Engineers, U. S. A.

SUBSIDENCE OF THE JETTIES AT SABINE

NEW YORK

GENERAL: I have the honor to forward herewi
subsidence of the jetties at Sabine Pass, Texas, fu
Heuer, Corps of Engineers. In a communication
matter, Major Heuer states:

> That the percentage of settlement on the east jetty (the
> while on the old jetty (west jetty) it is 32 per cent. If we
> into two parts, viz, submerged and that above mean low t
> of the submerged part to be 36½ per cent. Now, if we treat
> a jetty 27,000 feet long), the mean height of which was or
> subsidence amounted to 1.45 feet, the percentage of subsid
> This takes an extreme view of it. The measurements of
> taken from out to out. You remember our bottom fascines

er the jetties. The consequence is, the mud or sand beneath the mats flows into
nches and permits the mats to sink bodily. When our jetties are built up
high-water level, we, as a rule, have less subsidence than when they are sub-
d, and if the subsidence were due to compression only, we ought to get more in
gh jetty than in the submerged, because with a low tide we have all the weights
water pressing directly on our mud foundations, but with a high jetty there
no overfall, hence no scour due to that cause; yet we must keep our founda-
urse submerged and well in advance of our completed jetty to prevent injuri-
our in advance.

Very respectfully, your obedient servant,

D. C. Houston.

. Gen. John Newton,
Chief of Engineers, U. S. A.

showing amount of subsidence of west jetty, Sabine Pass, Texas, from date of con-
ion, in 1883, *to date of survey, September,* 1885, *considered in sections* 1,000 *feet long.*

nce of section from re origin of jetty.	Time between measurements.	Average height when built.	Average height in September, 1885.	Total subsidence.	Percentage of subsidence to first height.	Original average height referred to M. L. W.	Remarks.
Feet.	*Months.*	*Feet.*	*Feet.*	*Feet.*	*Per cent.*	*Feet.*	
0	31	2.6	1.9	0.7	27	+1.4	Average subsidence of portion originally above M. L. W. = 24½ per cent.
2,000	30	5.8	3.7	2.1	36	+1.4	
3,000	24	8.3	6.6	1.7	20	+0.8	
4,000	24	8.9	7.0	1.9	21	+1.0	
5,000	23	8.1	6.5	1.6	20	+1.0	
6,000	22	8.1	6.3	1.8	22	+1.4	
7,000	28	4.9	4.1	0.8	16	−1.5	Average subsidence of portion originally below M. L. W. = 36½ per cent.
8,000	28	5.4	3.4	2.0	37	−1.3	
9,000	27	5.0	3.6	1.4	28	−1.7	
10,000	27	4.4	3.1	1.3	30	−2.0	
11,000	27	4.5	2.6	1.9	42	−2.3	
12,000	26	5.3	3.1	2.2	42	−3.1	
13,000	25	5.9	3.7	2.2	37	−4.0	
14,000	25	6.0	3.5	2.5	42	−5.5	
15,000	24	6.2	3.2	3.0	48	−5.8	
16,000	22	6.4	3.7	2.7	42	−6.0	
00	26	6.0	4.9	1.9	—32	....	

first 7,000 feet of this jetty has this year been raised to an average height of 1¼
ove its original height, but this addition has been neglected in the above.

showing amount of subsidence of east jetty, Sabine Pass, Texas, from date of construc-
in 1885, *to date of survey, September,* 1885, *considered in sections* 1,000 *feet long.*

nce of section from shore origin of jetty.	Time between measurements.	Average height when built.	Average height in September, 1885.	Total subsidence.	Percentage of subsidence to first height.	Original average height referred to M. L. W.
Feet.	*Months.*	*Feet.*	*Feet.*	*Feet.*	*Per cent.*	*Feet.*
0	6	4.2	3.7	0.5	12	+2.3
2,000	4	5.5	5.0	0.5	9	+2.0
3,000	4	6.8	6.0	0.8	12	+2.0
4,000	4	7.8	7.0	0.8	10	+1.5
5,000	3	8.7	7.9	0.8	9	+1.7
6,000	3	8.4	7.7	0.7	8	+1.8
7,000	3	9.2	8.3	0.9	10	+2.2
8,000	3	9.4	8.4	1.0	11	+2.0
9,000	2	9.9	8.9	1.2	12	+2.4
10,000	2	9.0	8.6	0.4	4	+1.8
11,000	1	9.7	8.9	0.8	9	+2.3
00	3	8.1	7.3	0.8	9⅔	....

SURVEY AT SABINE PASS, TEXAS, BETWEEN THE JETTIES AN
TWELVE-FOOT CURVES LYING WITHIN AND OUTSIDE THE B

OFFICE UNITED STATES ENGINEER,
New Orleans, La., February 4,

GENERAL: I have the honor to forward a report and a tracin
survey made by Assistant Engineer Thomas L. Raymond, of th
tion of Sabine Pass, Texas, between the jetties and the 12-foot
lying within and outside the bar at this locality. The survey wa
during the last days of January, 1886. The result shows that
ties in their very incomplete condition are producing beneficial
in making deeper water. When the jetties were commenced w
feet of water on the bar. The jetties were extended to a short d
beyond the inner crest of the bar until work terminated on acc
exhaustion of the appropriation last September. Since tha
barely five months, the bar has been scoured until a depth of 8
water is now found at *low water*, and this channel is practically
wide. The 9-foot curve inside is pushing seaward, has advanc
feet; the 10-foot curve has advanced seaward 2,200 feet, showin
terial reduction in the width of the bar. As neither the Sabine
Neches rivers has been high, since work stopped last Septem
improvement of the channel must be attributed to the scour o
by the concentration of the tidal current directed by the jett
better results may be expected as the rivers rise. The scour on
is also taking place over a distance of 3,000 feet, measuring f
outer end of the east jetty. The outer ends of both jetties ab
level have sustained some damage from the action of the sea
can be remedied when work is resumed.

Respectfully submitted.

W. H. HEUER,
Major of Engi

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. THOMAS L. RAYMOND, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFIC
New Orleans, La., February

SIR: I have the honor to submit the following report upon the survey o
trance to Sabine Pass, Texas, made January 25 to 27, 1886, in obedience to
structions:

A chart† of the survey is herewith submitted comparing the positions of
tours of the survey of December, 1881, before the jetties were begun, with
equal depths determined by this survey. A comparative profile of the line o
water is also given to further illustrate the results obtained. The data from
of 1881 are shown in red.

It will be noticed that there now exists an 8-foot channel across the ba
least width of practically 400 feet, 7.8 feet being the shoalest intervening so
while in 1881 barely 6 feet depth could be carried across the bar.

The 6-foot and 7-foot contours have been obliterated within the limits of
vey, which extends from 12 feet depth inside to the same depth outside, and
west jetty to and beyond the east jetty line.

Comparing the 8-foot contours of 1881 and 1886, it will be seen that while
not now close across the bar, in 1881 the distance between 8 feet depth inside
side the bar was 7,200 feet.

The 9-foot contour inside has moved seaward 2,600 feet, while the outside
of the same depth has advanced into the Gulf, near the line of deepest water,
showing a net decrease of 2,300 feet in the distance between 9 feet depths ins
outside.

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* Tracing omitted.

† Chart omitted.

The 10-foot contour inside has moved down-stream 2,200 feet and the outside advanced 300 feet, a net decrease of 1,900 feet between inside and outside 10 feet depths.

There has been a considerable advance into the Gulf of the 8 and 9 foot contours to the westward of the channel, due to the formation of a bank against the foundation of the west jetty, built in 1883, but since the construction of the east jetty the area and height of this bank have been materially diminished.

To sum up the foregoing, the practicable depth across the bar has been increased fully 2 feet, or one-third of the original depth, by the incomplete works thus far constructed, while as far as the work has been carried the increase in depth upon the former crest of the bar has been from 2¼ to 3 feet, or about one-half of the original depth. Also a scour has been produced 3,000 feet beyond the end of the east jetty, with no alarming tendency to shoal beyond this having been developed.

An examination of the condition of the work, which was originally built to mean high tide, shows that about 700 feet of the east jetty and 5,500 feet of the west jetty remain uninjured, while beyond this on both jetties the top work is considerably damaged. In all about 4,000 feet of the top of the east jetty and 1,500 feet of the top of the west jetty have been injured.

Very respectfully,

THOMAS L. RAYMOND,
Assistant Engineer.

Maj. W. H. HEUER,
Corps of Engineers, U. S. A.

R 14.

IMPROVEMENT OF SABINE RIVER, LOUISIANA AND TEXAS.

A survey of the mouth of this river was made in 1871; it had a channel over the bar 3½ feet deep. In 1872-'73 the survey was extended from the mouth to Belgora, Tex. The information obtained did not warrant the expenditure of any money for improvement above Hamilton, Tex., about 247 miles above the mouth, to which point there is 3 feet depth for about three months in each year. The estimated cost of improvement over this stretch of river by removal of obstructions, such as logs, snags, fallen trees, &c., was $18,000. In June, 1878, Congress appropriated $10,000 for the improvement, with which a channel 6 feet deep, 70 to 100 feet wide, was dredged over the bar at the mouth. March 3, 1879, Congress appropriated $6,000 more, and provided for a resurvey of the river from its mouth to East Hamilton. After this survey was completed it was deemed advisable to expend this money in improving the river above Orange, and cuts were made from the main river into the narrows and at Dead Bend; large numbers of sunken logs and snags were removed from the upper part of the narrows, enabling vessel of 5 feet draught to get 30 miles up-river above Orange.

In 1880 Congress appropriated $5,000, and in 1881 $7,000 more, for this river. The bar at the mouth had again shoaled. This was redredged in 1881-'82 to a depth of 6 feet, and a channel 100 feet wide was made, a little over a mile in length.

In 1882 Congress appropriated $4,000 more for this improvement. As the river is in a sufficiently good navigable condition for the limited commerce which it carries, this money has not been used, and it, together with a small balance left over from former appropriations, is yet available. No work has been done during the past year.

CONDITION OF THE WORK AT PRESENT.

The dredged channel has shoaled somewhat, and many saw-logs have been lodged in it, but there is a deep enough channel for the very limited commerce using the river, and while the commerce is so small and

not perceptibly increasing it is deemed inadvisable to make
ther improvement at present.

It is not evident that the improvements thus far made hav
much, if any, commercial advantage. When the channel was
freight rates were not reduced, nor did the commerce on the
ceptibly increase.

No appropriation for the fiscal year ending June 30, 1888, i

Money statement.

July 1, 1885, amount available..
July 1, 1886, amount available..

R 15.

IMPROVEMENT OF NECHES RIVER, TEXAS.

The Neches River was surveyed in 1872–'73 from its mouth
ville, 195½ miles, and was found to be navigable at all stages
Bluff, 51 miles from its mouth and above that point only du
water, a large amount of lumber being shipped annually to Sa
and Galveston. The principal obstruction to navigation wa
at the river's mouth, the depth of water on which was 3 feet at
the bar is of fine sand and mud, the deposit of the river.

An estimate for dredging a channel to 5 feet depth, involvi
moval of 47,851 cubic yards of material, was submitted, amo
$26,318.

The act of June 18, 1878, appropriated the sum of $8,000 fo
ing the channel at the mouth of the river and removing obstr
Beaumont.

Advertisements under this act for dredging on the bar fai
sult, and after the passage of the act of March 3, 1879, appr
an additional $5,000 to the work, readvertisements were made
the resulting contracts a channel was excavated to the depth
and more at mean low tide, and to an average width of 60 fe
for 1,200 linear feet. An additional appropriation of $5,000
by the act of June 14, 1880. It was contemplated to use the f
made available in removing snags and overhanging trees betw
port and Yellow Bluff, but as the estimate for this work resul
the resurvey of 1880 amounted to $15,000, operations were s
until after the act of March 3, 1881, appropriated the sum o
when $7,465.50 were expended removing these obstructions,
being thus made navigable during high water, say three mon
year, to Bevilport, and during low water to Weiss Bluff. T
March 3, 1881, also provided for an examination or survey to
the practicability of a deep-water channel from Sabine Pass t
and Beaumont, and the estimates made in accordance with
visions was as follows:

For a 6-foot channel ....
For a 7-foot channel ....
For an 8-foot channel ....
For a 10-foot channel ....
For a 16-foot channel ....

It was noted in a report that the depth then existing (5 feet) was more than sufficient for all the requirements of commerce for many years to come.

By act of August 2, 1882, the sum of $5,000 was appropriated for continuing the improvement of the river, and in the annual report (1883) recommendation was made in the following terms:

> This amount is insufficient to produce a good channel at its mouth, and as this is the only place on the river really requiring improvement, it is thought best to hold this money until a further appropriation is made, then to cut a good channel say 100 feet in width and having 5 feet depth of water in it.

In the same report it was stated that:

> The channel across the bar had again shoaled until only 3½ feet of water could be carried over it, the bar being about 2 miles in length and requiring redredging about once in three years, for which, to obtain the channel mentioned above, the removal of about 40,000 cubic yards of material would be required, costing at 30 cents per cubic yard about $12,000.

No work has been done during the last fiscal year, and the recommendation that none be attempted with the balance on hand is renewed.

CONDITION OF THE IMPROVEMENT.

The depth of water in the cut across the bar seems to be generally about 1 foot less than that in Sabine Lake in the vicinity of the outer approach, quite enough for present needs.

There is no commerce upon this stream below Beaumont, with the exception of irregular trips of a small steamer to and from Sabine Pass, and as its draught is but 2 feet, the natural condition of the Neches Bar gives all the water needed for it.

For several miles below the town of Beaumont the forest growth along the banks is so high as to exclude the wind from sailing vessels to such an extent as to prohibit their use in the lumber trade without the assistance of tow-boats in this portion of their route, and, there being no tow-boat, no shipment is attempted.

Any improvement of the bar must then be supplemented by tow-boat service to be of any use whatever. Tow-boat service cannot be established and maintained unless the navigation over the bar shall be certain at all times. As any excavation through the bar will inevitably be filled up by deposits from the successive periods of high water, no relief other than the most transitory and unsatisfactory can result from dredging, unless indeed provision be made for keeping the bar dredged to the full depth required at all times and without fail. This course is, however, not recommended.

During the fiscal year 1884–'85 a resurvey of the bar at the mouth of the river was made. This channel has shoaled to 3½ feet of depth, and to deepen this channel to 5 feet would require the removal of 56,590 cubic yards of material at an estimated cost of $16,977.

The river is not susceptible of permanent improvement. With the money available from former appropriations, we can, when it becomes necessary, deepen the channel over the bar. Until this balance is used up, no further appropriations are recommended.

Money statement.

July 1, 1885, amount available	$11,667 84
July 1, 1885, amount available	11,667 84
Amount that can be profitably expended in fiscal year ending June 30, 1888 Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	11,667 84

R 16.

REMOVAL OF SUNKEN VESSELS OR CRAFT OBSTRUCTING
GERING NAVIGATION.

REMOVAL OF WRECKS IN HARBOR OF NEW ORLEANS, L

In reply to an advertisement inviting proposals for the
these wrecks, opened July 14, 1884, three bids were received,
rejected, being considered too high, and the work advertise
ferent specifications.

Proposals under the new specifications were invited and
gust 30, 1884. These bids were again rejected, the conditio
fications being considered illegal, and authority given to invi
posals by circular letters addressed to previous bidders.
these circulars bids were again opened on October 18, 1884,
bid received being that of the Atlantic and Gulf Wrecking
of Somers Point, N. J., their bid being:

For removal of steamship Gresham ....
For removal of ship Ailsa ....
For removal of steamship General Grant ....

This bid was approved and contract entered into Novemb
and approved by the Acting Chief of Engineers December 2

Work was commenced upon the removal of steamship Ge
during the latter part of November, 1884, and continued unt
1885, when, on account of high water, work was suspended.
resumed in August, 1885, and completed in December, 18
wrecks having been satisfactorily removed.

Amount expended during fiscal year ending June 30, 1886 ....

APPENDIX S.

IMPROVEMENT OF RIVERS AND HARBORS IN THE STATE OF TEXAS.

REPORT OF MAJOR S. M. MANSFIELD, CORPS OF ENGINEERS, BVT. LIEUT. COL., U. S. A., OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Entrance to Galveston Harbor, Texas.
2. Ship-channel in Galveston Bay, Texas.
3. Trinity River, Texas.
4. Buffalo Bayou, Texas.
5. Channel over the bar at the mouth of Brazos River, Texas.
6. Pass Cavallo Inlet, to Matagorda Bay, Texas.
7. Aransas Pass and Bay, up to Rockport and Corpus Christi, Texas.
8. Harbor at Brazos Santiago, Texas.
9. Protection of river-bank at Fort Brown, Texas.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., July 26, 1886.

GENERAL: I have the honor to forward herewith my annual reports relating to the river and harbor improvements under my charge for the year ending June 30, 1886.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Major of Engineers,
Bvt. Lieut. Col., U. S. A.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

S 1.

IMPROVEMENT OF ENTRANCE TO GALVESTON HARBOR, TEXAS.

Estimate of the Board of Engineers, January 21, 1886, House Ex. Doc. No. 85, Forty-ninth Congress, first session:

South and north jetties to crest of bar	$3,000,000
South and north jetties to 30-foot curve	7,000,000

ORIGINAL CONDITION OF THE LOCALITY.

The entrance forms connection between the Gulf of Mexico and Galveston Bay, and afforded a depth for navigation and commerce of about 12 feet over the outer bar and about 11 feet over the inner bar, with an intricate channel of 12½ feet, difficult of navigation. The outer semi-circular form, stretched from Bolivar Peninsula on the e Galveston Island on the west, measuring 10 miles along its crest as shown by Coast Survey Chart No. 105, had, in 1867, but 11 mean low tide in the best channel.

The inner bar, opposite the head of Galveston Island, was a obstructing Galveston Channel, and, according to Chart No. 105, mentioned, had a mean low depth over it of but 9½ feet.

The material composing the bars, as well as the upper stratum shoals, beaches, &c., has all the characteristics of a quicksand, b fine, rounded sand, comminuted shell, and sand and shells mixed entrance being greatly exposed to the action of storms, waves an currents, made frequent changes in the shape of the bars and the nels across them, the progressive movement of the inlet and c toward the southwest tending to injure the harbor, and eventu destroy it if permitted to continue.

PROJECT FOR IMPROVEMENT.

[Recommended by Board of Engineers.]

1. To build up and complete present south jetty to the crest bar.
2. To build a north jetty and complete it to the crest of the ba
3. To extend both jetties to the 30-foot contour in the Gulf.
4. To do such dredging from time to time, to aid the tidal-sc the rate the appropriations given may afford.

For reference, and to complete the record, the report of the Bo published herewith. (See paper marked A.)

OPERATIONS PRIOR TO JUNE 30, 1885.

The first appropriation was given in 1870, and from that year June 30, 1885, $1,576,337.12 (including $100,000 of funds of the Galveston) was the total sum expended under direction of the States upon works of improvement at this point. The result of penditure of this money may be shown in the following manner.

The Coast Survey chart of 1867 indicated that the best water channel across the inner bar was then but 9½ feet at mean lo affording for navigation passing to or from the city a depth of ceeding 11 feet at ordinary high stages. At the present time (J 1886) the available water-way for vessels is not less than 20 fe at mean low tide, and this depth—in a good wide channel—is t tained over a shoal at the head of Galveston Channel, which is by the passage of sand through the dilapidated Fort Point pil opposite, built many years ago by the city of Galveston. The de inner bar at time of last survey, June, 1884, was 26 feet, which is supposed to have been held up to the present.

The outer bar (as shown by same Coast Survey chart of 1867 mean low-water depth of 11 feet and an ordinary high-water de crossing of about 12½ feet. In 1884 (survey of June) it was fou the mean low-water depth of bar-channel was 13 feet—the same a the previous year—and afforded for navigation at high tide a d not exceeding 15 feet. This satisfactory condition has prevailed present time, as inquiry of the pilots fails to show any detri changes affecting either of the bar-channels.

In the last Annual Report it was mentioned that no construction work could be attempted in the year 1885–'86, because of want of sufficient funds; $1,662.88 was the amount available, and was exhausted (save $96.98 retained to meet non-payments on rolls) in making the examinations, &c., of south jetty required by the Board of Engineers.

PROBABLE OPERATIONS OF THE YEAR ENDING JUNE 30, 1887.

Whatever funds may be appropriated for continuing work at this point will be expended to the best advantage, and in the manner outlined by the Board of Engineers in its report of January 21, 1886.

The estimated amount required to carry completed jetties to the crest of the bar, with a view to obtaining a depth of 16 to 20 feet for navigation, is $3,000,000; to extend the jetties to the 30-foot curve, to obtain a 25 or 30-foot channel, $7,000,000. The estimate is made contingent upon free supplies of money.

The work is located in the collection district of Galveston. The nearest light-houses are at Bolivar Point and Fort Point, at entrance to Galveston Bay.

Money statement.

July 1, 1885, amount available		$1,662 88
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$1,565 90	
July 1, 1886, outstanding liabilities	84 78	
		1,650 68
July 1, 1886, amount available		12 20
Amount appropriated by act approved August 5, 1886		300,000 00
Amount available for fiscal year ending June 30, 1887		300,012 20
Amount that can be profitably expended in fiscal year ending June 30, 1888		1,000,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.		

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, GALVESTON, TEX.,
Collector's Office, July 1, 1886.

Statement of tonnage at the port of Galveston, Tex., for the fiscal year ending June 30, 1886:

Description.	Number.	Tonnage.
Foreign vessels entered	164	115,487
Foreign vessels cleared	....	....
American vessels entered foreign	16	8,706
American vessels cleared foreign	21	13,634
Coasting trade entered	317	319,005
Coasting trade cleared	295	309,490
Totals	977	882,311

CHAS. C. SWEENY,
Collector.

found that the jetties were recommended, especially their outer portions, in their first construction, to be kept low, with the intention, from the experience gained, to apply a suitable top-dressing sufficiently strong to be reasonably permanent. The actual ultimate height of the jetties would necessarily be a result of experience and of the depth to be acquired over the bar.

The parallelism of the jetties, as found in the original project of Major Howell, was, however, modified, by inclining the south jetty towards the other, and by the recommendation of the Board that, after carrying out the two jetties a certain distance, about half their proposed length, observations should be made with the view of changing their directions; that is, bringing them nearer together.

The difference between low jetties and high jetties is one of degree, not of kind, though it has been industriously promulgated that their effects are diametrically opposite. The contraction produced by the one is greater than that of the other, but is greatly more costly both from bulk of the jetties and their exposure to destructive agencies, so that if the moderate contraction proposed by the other should be sufficient it would be more advantageous to accept it.

The special Board of 1880, called together after an interval of several years to discuss the situation at Galveston, where, contrary to its advice and recommendation, a gabionnade of 9,707 feet had been constructed on the line of the proposed north jetty, sent one of its members to inspect the work, and in the report of June 7, 1880, states:

> It has failed, however, as applied to the Bolivar jetty, to gather sand-drift and to constitute a pier. In fact, the gabionnade has essentially gone down below the original bottom.

Consequently it could not serve to direct or confine the currents. It will be noted that the date of this report is prior to the commencement of the south jetty by Colonel Mansfield, and this fact constitutes a sufficient answer to the reckless and false statement said to have been uttered upon the floor of Congress, that the north jetty was in condition to act when the south jetty had been finished, and that the want of success in deepening the bar proved that the plan of the engineers had been a total failure; whereas there was but one jetty, the south, the portion of the north jetty constructed having been years before the speech swallowed up in the sand. The same report of June 7, 1880, discusses various forms of jetty as to material of construction for the information, though not as confining the efforts, of the constructing officer. Alluding to the employment of mattresses the report says:

> As small stones upon structures exposed to the action of breakers will be more or less displaced during storms, we must anticipate some damage to result from the application of either of the above methods to the construction of the Galveston jetties. Either of them, however, will probably prove a success, provided the brush collects sand and the stones become bound together by molluscous concretions, which usually grow rapidly in warm climates. Experience in Charleston Harbor and on the shores of Holland, especially at the mouth of the Maas, bears testimony to the rapid growth of these mollusca upon loose stones immersed in the sea near the outlets of fresh-water tributaries, and to their effective use in cementing them, as it were, in one mass. Though we anticipate with no degree of certainty the same favorable results at Galveston as at Charleston, yet it seems probable that similar shell deposits will occur, and that the brush and stone will collect sand in process of time. *Unaided by such favorable action*, the solidification of the jetties will be *difficult and costly*. [The italics are my own.]

It will thus be seen that the Board gave a timely warning. The south jetty, as far as the funds allowed, had been finished prior to my taking charge of the office of the Chief of Engineers, and had been brought to the level generally of low water, in some places higher and in others lower than that level. No appropriation has been made for since 1882, and the mass of brush in the mattresses loaded paratively small stones has been left during this long perioc to the attack of the teredo and to the wash of the breaker should have been promptly loaded and covered with stone lar to resist displacement. If serious damage has resulted, it mu be imputed to this omission. At the mouth of the Mississip Sabine, where the bottom is mainly of mud, the condition of will be a protection against the rapid ravages of the teredo.

In the report of the special Board of October 31, 1880, pa the Report of the Chief of Engineers for 1882, the Board sta

> An ordinary enrockment would stand probably as well upon the sands or bar as in similar positions at the north. Breakwaters in Long Island along the coast of Massachusetts and Maine are simple enrockments. either mattresses or grillages, have been required for those construction would be needed on the Galveston Bar if stone could be delivered as ch (say from $1 to $1.25 per cubic yard) as in northern sections of the co wearing of currents or the overfall at the foot of the jetties would merely the stone at the edges thus (Fig. A). But as stone costs $4 and brush yard, economy of construction demands the use of the latter as far as pos

The special Board from 1874 to 1880 was called together at i intervals, and only to act upon some point presented to it, a the intervals had no oversight or advisory control over the o The Board never possessed executive functions.

In the spring of 1885 I directed cross-sections to be taken of jetty, in order accurately to know its condition, with the ob after reference of the whole subject to the permanent Board fications and Rivers and Harbors. The members of the Boa Galveston, and after an elaborate study of the subject have their report, a copy of which is respectfully submitted.

I think it important to call attention to the careful analysis the Board of the problems submitted to it.

Among other results the Board reports that the 24-foot cu sea-face of the bar has moved seaward since 1851 100 feet p and the 18-foot and 12-foot curves at a greater rate. This is posed to be entirely due to the works that have been construc this action preceded their construction, though to a less amou

The trenches on either side of the jetties are not of unusual o in such situations. In the present case they have been attribu overfall of the tides, and may be due also to the racing of t along the jetties.

The sand movements along the bottom and shores are, in t of the Board, nearly equal in a northeast and southwest dire

The inner bar has been greatly deepened by the action of already constructed, and may be further deepened to meet an of depth on the outer bar.

The south jetty has, from exposure to the various degradir lost about 61 per cent. of its original height. It will yet foundation for a stone enrockment to complete the structure it above the water. If it be purposed to continue the imp one million of dollars might be profitably expended during t year, and I strongly recommend, as the least amount to be and to preserve the foundations, that $320,000 be appropriat

I invite particular attention to the conclusions of the Boa great contraction of the channel by jetties would but slightl the velocities of the currents and extreme depth in the chan it would on the other hand ruin the harbor of Galveston, as well as expose the jetties to destruction.

The influence of too much contraction would be to diminished greatly the tidal prism in Galveston Bay; and the Board also states:

> If the jetties had an interval of about 10,000 feet and the Bolivar Gorge were widened to that amount, after a deep channel way was formed, the tidal prism of Galveston Bay would be about the same as at present.

In another part of this report it is stated:

> Such storms will endanger jetties 7,000 feet apart. If made narrower, the time of outflow would be prolonged in proportion, and hence the danger of undermining the jetties and of cutting channels across Galveston Island would be still greater.

But it is impossible in a brief space to do more than call attention to some of the important results of calculations made by the Board. The whole paper deserves a careful study.

In conclusion, I beg leave to now supply the omission in the earlier portion of this letter, to state that the special Board from 1874 to 1880, the period of its connection with the subject, had the problem submitted to it of gaining a moderate depth over the bar, and that the present depths of 25 to 30 feet on the bar were not then contemplated.

Respectfully submitted.

JOHN NEWTON,
Chief of Engineers.

HON. WM. C. ENDICOTT,
Secretary of War.

REPORT OF BOARD OF ENGINEERS.

OFFICE BOARD OF ENGINEERS FOR FORTIFICATIONS
AND FOR RIVER AND HARBOR IMPROVEMENTS, &C.,
New York, January 21, 1886.

GENERAL: The Board of Engineers has to acknowledge the reference to it of the subject of the improvement of Galveston outer bar by your letter of July 25, 1885, and, after a personal inspection of the present condition of the work, submit the following report:

1. DESCRIPTION.

Galveston Bay is a shallow body of water, separated from the Gulf of Mexico by a low sand island 27 miles long and a mile or two in width, on which Galveston City is built, and by a spit 20 miles long, called Bolivar Peninsula. The bay is connected with the Gulf of Mexico by San Luis Pass, at the western end of Galveston Island, and by the Bolivar Channel, at the eastern end. The length of the bay along the shore is about 50 miles, and its most distant point is about 25 miles from the Gulf coast. Its area is about 490 square miles. If it be assumed that the part of the bay west of Deer Island is served by San Luis Pass, it leaves 450 square miles for the area depending on the Galveston entrance. San Luis Pass is the smaller entrance. The main entrance to the bay is between the east end of Galveston Island and Bolivar Peninsula, and it has a present width of about 8,200 feet. The interior of the bay, aside from the main entrance, has depths which do not exceed 11 feet at mean low water (the plane to which all depths refer) except where tidal channels have been formed. Thus on the north

protruded, from the inside, channels whose outer
gave 10 to 12 feet depth.* Swash channels along
along Galveston Island have existed; also chan
east from the 24-foot area already referred to, an
channels shifted with storms, but the main cha
a line running east from the deep area.

From the east end of Galveston Island a jett
to the southward of the 24-foot area. Its gen
south of east, and its length 22,551 feet. In June
top of the jetty below mean low water varied fro
on the outer 10,000 feet of the jetty averaging 6 c
built in 13 feet of water, on the outer slope of t
depths somewhat greater than 12 feet, which
on the main channel bar before its construction.

The general direction of the Gulf shore of Ga
Bolivar Peninsula is about northeast. Immed
veston entrance, however, for a distance of 4 m
outer curves run nearly north, thus correspondi
shape of the shore-line, since the east end of Ga
more into the Gulf than does Bolivar Point.

Galveston Island is low, and the part east of
Channels of considerable depth are sometimes
island in storms.

2. CHARACTER OF BAR.

Borings on the outer bar at Fort Point and a
that to depths of 39 feet the bottom is composed c
shells. An examination by the Board of a samp
point on the prolongation of the south jetty in 2
that it was mainly composed of rounded silicic
about $\frac{1}{200}$ inch in diameter, very few rising to
smaller subangular fragments. Digested in n
cent. in bulk, this loss being chiefly due to t

final velocities of only one or two inches per second. In other , vertical currents of one or two inches velocity per second would uch sand permanently in suspension. This gives an idea of the ease with which the sand is moved by water.

ımple of the sand from a point 1,100 feet northeast from Fort Point ıouse had very few particles reaching $\frac{1}{100}$ inch in diameter, the ;e being about $\frac{1}{150}$; but it contained unbroken valves of shells ıme fragments of shells an inch in length.

3. WINDS.

following tables for the years 1880–'84, derived from the Signal e reports, show for Galveston the average frequency of winds for nt-months and for the year:

MONTHLY AVERAGE FOR FIVE YEARS 1880–'84.

Months.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
	21.4	12.2	11.2	14.8	18.2	6.2	1.6	6.6
	12.4	9	8.8	19.4	23.6	3	2.8	6
	11.8	10.6	8.3	24	24	6.3	2.8	5.4
	9	6.8	8.2	23.2	27.2	9.8	1.8	3.8
	5.8	6.6	9	32.2	28.2	5.2	2	3
	3.2	3.2	5.4	20	42.8	9	3.4	2
	1.2	4.6	2.2	17.4	39.8	20.4	4.4	2
	5.2	5.8	9.4	26.6	27.8	9.8	5.4	2.4
er	9.6	8.4	10.2	31.8	21.8	2.2	1.6	3
	15.4	11	11.2	30	16.8	3.4	1.2	3
r	18.4	16.8	17.8	13.6	14.8	2.2	1	4.6
r	19.2	12.2	14.8	11.6	17.2	8.8	3.2	5.6

YEARLY DISTRIBUTION.

	140	130	168	314	226	39	24	53
	124	77	74	240	328	124	43	66
	125	100	68	239	366	96	27	43
	132	127	119	265	306	87	21	25
	142	102	123	265	285	85	41	50
rs.	663	536	582	1,323	1,511	431	156	237
	12.2	9.8	10.7	24.3	27.7	8.0	2.9	4.4

examination of these tables shows that of the winds observed be- 1880 and 1884, inclusive, 41 per cent. were from the NW., N., or he first two directions being off-shore winds and the last being ly on-shore wind. The waves resulting from such winds should no great effect in moving sand along the shore; per cent. of the were from the NE. and E.; their waves should give a south- rly motion to the sand; 36 per cent. were from the south or south- these should move the sand toward the northeast.

4. STORMS.

he case of storms the forces in action much exceed those at other Colonel Mansfield states that such storms occurred in 1853, 1867, nd 1877, and that there have been none since 1877. A description great storm of September 14, 1875, may be found in the Chief of En- s' Report for 1876; and of the storm of September 16, 1877, in a manu- report of H. C. Ripley to Lieut. C. E. L. B. Davis, dated October 3, the Bolivar Gorge, and it is very desirable to know approximately the velocities they produce; these velocities depend on the tidal prism.

Unfortunately data as to these special tides for points in the interior of Galveston Bay are not available, but there are data as to the average of all tides. From the Chief of Engineers' Report, 1877, Part I, page 163, the following may be derived:

Average tide at Galveston	1.10
Average tide at Halfmoon light-house, 6 miles from Fort Point	0.85
Average tide at Red Fish light-house, 14 miles from Fort Point	0.48
Average tide at Morgan's Point, 26 miles from Fort Point	0.38

These figures show that Galveston Bay is very far from being filled during a tide by the present entrance. If high and low water were simultaneous at all these points, the tidal prism for the 451 square miles of Galveston Bay which has been assumed as dependent on the Galveston entrance would be about seven thousand million cubic feet for a 1.1 feet tide at Galveston.

Of the interval of time between high water at Galveston and at Morgan's Point the Board has no information. An examination of some tidal observations at Red Fish light-house from January to March, 1877, indicates that the average delay to that point, 14 miles from Galveston, was about two hours counting from Bolivar Point. This delay makes the tidal prism less than it would otherwise be, and the seven thousand million cubic feet given above needs multiplication by a coefficient which may be taken as 0.7 or 0.8, giving about five thousand million cubic feet as the tidal prism for an average tide of 1.1 feet. This average tide, as it includes the effect of days when there are two tides a day as well as those when there is but one, is but 18 hours long; its time of rising being 7.3 hours and of falling 10.3 hours, as derived from six months' observations in 1878.

In estimating the tidal prism for the great declination tides of 1.8 feet it must be noticed that the tides are about 24 hours long, and that having risen to high water is 9.2 hours before they have fallen so much as 0.5 foot. This gives a very much longer period of nearly high water in which to fill the interior bay than in the case of the average tide, and it seems probable that the interior tides are increased in a greater ratio than those at Galveston, and sufficiently or more than sufficiently to cover the delay in time of high water at the interior stations. It will accordingly be assumed that the times of high and low water for these tides over the bay may be taken as simultaneous, provided the interior tides are increased in the same ratio as those at Galveston, that is in the ratio of $\frac{1.8}{1.1}=1.6$.

Computing for the 1.8 feet tides the tidal prism with these assumptions, it is found to be ten thousand seven hundred million cubic feet. Calling, in the absence of knowledge of its exact value, the duration of outflow 12 hours and the half tide cross-section at Bolivar Gorge* 160,000 square feet, there results for the mean velocity of outflow there during the ebb tide 1.55 feet per second.

It is also desirable to know the maximum value during one tide of the mean velocity at Bolivar Point. When the tidal heights give with times as abscissas a tidal curve of regular and nearly sinusoidal form, as is the case at the Narrows in New York Harbor, the velocity curve

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*In the Bolivar Gorge section, having an extreme length of 8,195 feet, 1,360 feet of shoal water near Bolivar Point has been omitted. It reduces the cross-section by but 3 per cent. Its retention would give a value smaller than is just for the hydraulic mean radius.

Section.	Hydraulic mean radius R.	Maximum mean velocity.	C.	S.	Distance between sections.	Fall.
	Feet.	*Feet.*			*Feet.*	*Feet.*
Bolivar Gorge	23.4	3.1	99	0.000042	....	......
Half way to outer bar	11.3	1.7	92	0.000030	10,250	0.37
Crest of outer bar	9.7	1.2	91	0.000018	5,750	0.14
At 30-foot curve	23.8	0.28	100	0.0000003	11,000	0.10
Sum					27,000	0.61

That is, when the mean velocity at Bolivar Gorge is 3.1 feet per second, the difference of level, there and in the Gulf, needed to overcome friction is, roughly, 0.61 foot. As the inflowing water is accelerated and the outflowing retarded by 3.1 feet per second, to obtain the actual falls the head due this acceleration, or 0.15 foot, should be added to the inflow fall, and be subtracted from the outflow fall, giving 0.76 foot and 0.46 foot for the total falls in the two cases.

In the great storm of 1877 the water at Galveston fell 6.5 feet in 23½ hours. If it be assumed that the mean fall over Galveston Bay was 3 feet, the mean velocity during the 23½ hours through Bolivar Gorge would have been 2.7 feet per second, or at its maximum about 5.4 feet. But since much water flowed outside the channel, these velocities would be reduced by 10 or 20 per cent. Such a velocity through jetties on this fine sand might threaten their stability. These estimates are based on the supposition that the mean fall over the whole bay was but 3 feet. No exact information as to the fall at interior points of the bay is at hand. If it was 6.5 feet, as at Galveston, double the above velocities would result, which confined between jetties, even although far apart, would severely try their stability.

6. PAST CONDITION AND CHANGES.

At the request of the Board, a comparative chart showing the surveys of 1851, 1872–'73, 1875–'76, and 1884 has been prepared. From a study of this chart some general results may be obtained.

South of Bolivar Point the 6-foot curve has moved south 800 or 1,000 feet since 1851, but a mile to the northeast there has been little change. Between Bolivar Point and Fort Point the 24-foot curves of the Bolivar Channel have moved slightly south, but have been practically stationary. At the east end of Bolivar Channel the 24-foot curve has moved east or seaward about 5,000 feet between 1851 and 1884, moving also a little to the north. At the west end of Bolivar Channel, between 1851 and 1876, the 24-foot curve moved westward about 2,000 feet.

On the Gulf slope of the main bar in the prolongation eastward of the Bolivar Channel the 24-foot curve has moved steadily seaward by about 3,500 feet between 1851 and 1884, while the 18-foot curve has moved 5,000 feet and the 12-foot curve 7,000 feet. Unfortunately late surveys do not extend to the 30-foot curve; hence no definite statement can be made as to its motion.

The 12-foot, 18-foot, and 24-foot curves, at points about 9,000 feet north of their intersection with the prolongation of the Bolivar Channel and 16,000 feet southwest from the same intersection, have retained nearly the same position since 1851. In other words, the sea face of the bar east of the Bolivar Channel has moved steadily eastward since 1851, the advance being confined to a length of about

The chief cause of the shoaling appears to be the movement of sand from the south side of Galveston Island into the harbor. The stoppage of this movement by work at various times, and now by the south jetty, gave in 1884 depths of 21 feet on this inner bar. There is, therefore, now no need of doing more than to hold the present depths until the depth on the Gulf bar has been made equal to that on the inner bar. Then there will be no great difficulty in increasing it. Works for the second object were (1) the gabionnade built out from Bolivar Point to a length of about 10,000 feet in 1876–'80. This gabionnade has been buried in the sand or destroyed, and is abandoned. (2) A south jetty was then built, running from Fort Point in a direction a little south of east, and having a length of 22,551 feet. Its bottom width increased from 30 feet to 120 feet in going from the shore to the sea end. Its top was rounded, so that the top widths, which are greatest at the outer end, cannot be accurately stated; they may be called from 12 to 24 feet. The jetty was built of layers of brush mattress, about 18 inches thick, and layers of stone; about one-third the volume was of stone. A longitudinal and transverse section are given on sheet 3, herewith.

As this jetty has settled badly, an examination of the causes of settlement was made at the request of the Board, and the results are given in the letter of Major Mansfield to the Chief of Engineers herewith of November 17, 1885, and in the report of Mr. Picton of November 6, 1885 (Appendix B).

In general terms the results are as follows: At five places distributed along the jetty the average of original heights was 9.37 feet. The average subsidence of the top is 5.77 feet, or 61 per cent. Borings in the center of the jetty in each case showed that the base of the jetty there had not settled. The subsidence there then must be attributed to the compression of the brush-work of which the mattresses were constructed, this compression being increased in places by the very serious injury which the teredo had done to the brush itself, or possibly in some cases, although none are reported, to the destruction of the top mattress. At certain distances from the axis of the jetty, points are reached where but a single mattress should be encountered in boring. On the south side, and within 9,310 feet of the outer end, examinations showed that the single mattress had settled from 5 to 8 feet, this apparently being due to scour through the mattress of overfall currents and waves. At one boring, 581 feet from the outer end, no trace of the mattress placed there could be found. At 9,301 and at 16,801 feet from the outer end of the jetty the scour under the mattress extended nearly to the axis of the foundation, here 90 and 60 feet wide, and in the vicinity of the latter point there was a scour of from 6 to 12 feet on both sides of the jetty. In connection with this subject a report of Major Mansfield to the Chief of Engineers, of July 29, 1885, inclosing Mr. Ripley's report and sections of the south jetty, is given in Appendix A.

Major Mansfield (Chief of Engineers' Report, 1885, page 1450) gives the cost of the south jetty at $3.29 per cubic yard. A settlement of over 50 per cent., if due to compression, more than doubles this cost per cubic yard after settlement, and makes it exceed the cost of rubble-stone, which may be taken as $3.50 or $4 per cubic yard. The use of stone for the bulk of the jetty is then preferable to that of brush-work, which may be seriously injured by the teredo. An examination of the cross-sections of the jetty, given on sheet No. 3, herewith, shows that for the outer 9,310 feet the highest point is now 10 or 20 feet to the north of the longitudinal axis, and from 1 to 3 feet higher than at the axis where, when first constructed, the height was greatest. This in

dicates either a movement of the stone on the top of the jetty northward or scour under the south side of the jetty, or a comb of these two causes.

9. PLAN OF JETTIES.

A statement of the existing conditions at Galveston entrance l been given. Deeper water on the bar is needed, and the questi considered is, how that deep water can be obtained. The rec methods are two—(1) by dredging alone; (2) by using tidal sc tween jetties, aided, if necessary, by dredging. The first metl already been tried unsuccessfully by Major Mansfield (Chief o neers' Report, 1884, Part II, page 1298). With the very mobile of which the outer bar is composed and its great exposure, lyi does about 4 miles from land, there is not, in the opinion of the sufficient prospect of results commensurate with the cost of d being obtained and maintained to justify further experiment. ond method would include the obtaining of a deep channel-w tected by jetties from the deteriorating effect of wave-action a the influx of sand, and the maintenance of that channel-way by of tidal scour, supplemented, if found necessary, by dredging. ties should be so placed as to secure the greatest tidal scour pra without seriously injuring the interior harbor, and without gre dangering the safety of the jetties against undermining, or of Ga Island against overflow in great storms. The greatest scourin will be obtained, and the greatest security against undermin making the jetties tight and by raising them above high water.

In fixing the interval between the jetties it must be remembe the velocity of the water flowing through them will depend on of its surface and on the depths. In what follows, it will be a for the purpose of discussion, that jettied channels of different but all having the mean depth of the Bolivar Gorge section pr given, namely 23.4 feet (corresponding to a maximum depth of have been formed, and it will be the falls and velocities throu channels which will be considered, since these velocities would natural agencies efficient in maintaining such improved channel

How will these falls through such jetties vary, as the inter tween the jetties vary?

For an inflowing tide with the present entrance it has alrea seen that the fall from the 30-foot curve to the Bolivar Gorge, a of 29,000 feet, is, approximately, 0.76 foot.

Suppose a channel of the same width (6,835 feet), cross-section square feet), and mean depth (23.4 feet), as the part of the Boliva section we have been considering be opened to the 30-foot curve the formula previously given compute for 0.9 foot fall (which, be seen hereafter, is the greatest possible fall for a tide of 1.8 f velocity through it (first deducting from the total fall 0.10 foot needed for acceleration, leaving 0.8 foot to overcome friction) a results 2.5 feet as the maximum velocity this fall could give such a jettied channel. As the actual fall would be somewhat l the maximum 0.9 foot the velocities would not exceed 2.4 feet.

Again, suppose a jettied channel of the same mean depth, but of times the width of the Bolivar Channel, to be opened from Ga Bay to deep water outside. Such an entrance would fill Galvest rapidly, and filling it so rapidly there would never be a diffe level between its inner and outer ends nearly as large as now e the places of those ends. Now, let this width be gradually diminished; the bay during rising tide would fill more slowly, and its surface would have greater differences of level from the open Gulf than before—that is, the maximum difference of level would increase. If the narrowing process were continued till the interval between the jetties were reduced to a few feet, water enough would not flow through them during a rising tide to seriously affect the level of Galveston Bay, and the difference of level would reach its maximum value. The level of Galveston Bay would then be constant—namely, the level of half tide; and since the tides we are considering are 1.8 feet tides, it follows that no matter how small the interval between jetties 29,000 feet long is made, the maximum value of the fall through them for a tide of 1.8 feet is one-half that tide, or 0.9 foot.

It has already be seen that if the Bolivar Gorge section were carried out to sea between parallel jetties the maximum velocities through it would not exceed 2.4 feet for the 1.8 foot tide which now gives 3.1 feet maximum velocities in the Bolivar Gorge. In other words, such a jettied channel offers more resistance to inflow than does the present entrance; reduces the present tidal prism about one-third; allows the bay to fill more slowly than the present entrance does, and hence gives greater differences of level than the 0.76 foot given by the present entrance. As the interval between parallel jetties 29,000 feet long, then, is narrowed from 6,825 feet to, say, 100 feet, the fall through them or the maximum depression of the bay below the Gulf only increases from some such quantity as 0.8 foot to 0.9 foot, and the maximum increase in velocity, therefore, would not exceed 6 per cent. While these computations are only approximations, as any such estimates must be, they show very clearly that narrowing the interval between the jetties below 7,000 feet, no matter to how great an extent, but very slightly increases the velocity through them.

Diminishing the interval between the jetties from 7,000 feet to 3,500 feet changes the differences of level between the bay and Gulf but slightly. Through the opening of the same depth and double width, about twice as much water will flow in and out, but as it flows through a double cross-section its velocity is nearly the same, and as the depths it can maintain depend on the velocities, other things being equal, the depths also will be nearly the same. There is, then, very little to be gained in the way of velocities or of depths that will be maintained by them, by narrowing the interval between the jetties to 2,000 feet, as proposed by Mr. Eads to the River and Harbor Committee, May 22, 1884, as reported in the Galveston News of June 2, 1884:

> Mr. BAYNE. Nothing like 12,000 feet?
>
> Captain EADS. That is a matter I should take into serious study before I should determine what particular width and direction I should give, but I do not take it to be over 2,000 feet.

But there is very much to be lost. A reduction of the entrance width to 2,000 feet would reduce the amount of water entering and leaving Galveston Bay during a tide of 1.8 feet to about one-fourth of its present amount. The tidal channels which are now kept open by this water would shoal up; the reduction would probably ruin Galveston Harbor proper and very largely diminish the depths at the Bolivar Gorge. Aside from the great damage it would do to all the tidal channels now existing inside of the outer bar, it would also increase the danger of injury to the jetties in great storms. In such storms, with winds from northeast to south, Galveston Bay, as already seen, may slowly fill to great heights; if, then, the wind suddenly shifts to north or northwest from south, the water is driven out with high velocities. In 1 this way, a deep channel was cut across the eastern end of Gal Island, and the main bar was cut down. Such storms will en jetties even 7,000 feet apart; if made narrower the time of c would be prolonged in proportion, and hence the danger of und ing the jetties and of cutting channels across Galveston Island be still greater. If the jetties had an interval of about 10,000 fe the Bolivar Gorge were widened to that amount, the tidal p Galveston Bay, after a deep channel-way was formed, would b the same as at present. But the cost of the work would be g comparison with the resulting benefits.

These considerations lead the Board to the conclusion that w jettied channel is fully formed its cross-section should not be le that of the section at Bolivar Gorge. Even with that section th mum velocities through the jetties will be about one-fourth less t existing maximum velocities through Bolivar Gorge for a 1.8-fo and the tidal prism of Galveston Bay will be reduced by ab same fraction. The present effective cross-section at Bolivar G 6,835 feet wide, with a mean depth of 23.4 feet and a maximum d 41 feet. The Board therefore proposes 7,000 feet for the interval b the outer ends of the jetties. The south jetty should be cons on the present south jetty (using the side of shoalest water) an prolongation. The proposed site of the north jetty is shown o No. 1, herewith.

The depth which such jetties will maintain cannot be stated wi cision. Some general considerations bearing on the subject given. It has been seen that a 1.8-foot tide now gives a ma mean velocity over the outer bar of 1.2 feet. Since the bar is l front of the Bolivar entrance than nearer land, the velocities ar ably somewhat greater here than their mean value, but how muc known. With the proposed jetties the maximum mean velocit be increased here (the whole channel being supposed to be forme to give a cross-section equal to that at Bolivar Gorge) to about The effect of the jetties would then be to give, where the bar velocities about double those existing there at present. Wha these new velocities will maintain in the jettied channel, were it means once fully formed, cannot be stated with exactness. Ma velocities for the 1.8 foot tide (equal to 3.1 feet per second) now m a mean depth at Bolivar Gorge of 23 feet, and a maximum dep feet, while the corresponding mean velocity on the bar of 1.2 fee tains there a mean depth of about 10 feet, and a maximum of 1 feet. Did the mean depths vary simply as the mean velocities th depths in Bolivar Gorge and on the bar would indicate a mean c about 18 feet between the jetties for 2.4 feet maximum mean v At the Bolivar Gorge section the maximum depth of 41 feet is 1. the mean depth 23 feet. Should the same ratio exist between ties the maximum depth maintained in the jettied channel w about 32 feet.

Thus far the jetties have been supposed to prevent any pas water through them or over them. But it is not practicable t them absolutely tight. If of rubble stone and five miles long, w ferences of water-level near their shore ends often reaching 0. foot, the leakage through this portion will be considerable, reduc amount of water that would otherwise flow between the outer the jetties, and perhaps causing settling. This escape in some diminishes the velocities near the ends of the jetties, and the those velocities would maintain. Unless fine material can be obtained to fill the interstices between the rubble and make the jetties compact, it may be found advisable to build for that part of the shore ends which will not soon be protected by the shore-line advance, a wall about 4 feet thick, of concrete in bags, to prevent this escape where it would be most serious. For fine material coarse gravel would be excellent.

There is, however, a point to be considered, wherein the effect of jetties is in favor of greater depths for given velocities than are maintained now. The depths tidal currents can maintain depend, not only on their velocities, but also on the strength of the causes tending to destroy or degrade their channels. At present the outer part of Bolivar Channel is exposed to the free influx of sand from the shore, under the action of lateral currents and waves; with jetties completed the wave action will be much reduced, and the currents will flow in the direction of the channel—both favorable to greater depths than equal velocities would now give.

Again, at present great and lasting effects in increasing depths cannot be attributed to the extreme tides, which only occur a few times in a year, since the degrading causes are incessantly in action. With a channel once jettied the power of the degrading causes would be weakened, and the effect of the great and rare tides would be more lasting.

On the whole, therefore, there is reason to expect that the proposed jetties, when the channel is once formed, will maintain some such depth as 25 or 30 feet. They will maintain practically all the depth that could be maintained by tidal currents between any jetties however near each other, but will not involve the dangers already specified of close jetties. In forming the channel at first dredging might be useful, or even necessary, should hard places be found. If appropriations be large it would hasten the time when the new channel would be fully developed, since the process of scouring out the jettied channels by the tidal currents would be a slow one. The advisability of dredging would depend much on the rate at which appropriations were given. Should the jetties fail to maintain the depth of 30 feet desired by Texas, they would give a protected area within which dredging to that depth would be easy, and the dredging would be reasonably permanent.

It will be seen that the Board does not attempt any prediction of the precise depth the jetties will maintain. Such predictions can best be made by those ignorant of experience in tidal entrances elsewhere and having great confidence in the credulity of mankind.

The case differs widely from that of South Pass. There, by proper works, the same amount of Mississippi flow can be forced through the jetties, whether the water-way is about 900 feeet wide, as at first constructed, or about 600 feet wide, as is now the case at the narrowest place; and the same amount flowing through a narrower water-way necessarily gives greater depths. But at Galveston before the water can flow out it must flow in, and any serious reduction of the inflow cross-section below the section now existing at Bolivar Gorge at once reduces the tidal prism of Galveston Bay and the amount of outflow in about the same proportion. The reduction of width from 900 to 600 feet in the much simpler case of the South Pass sufficiently indicates the uncertainties in such works and the small value of predictions.

The facts that the bar, including its outer 24-foot curve, has been moving steadily seaward in front of the Bolivar Gorge since 1851, and that this motion existed before the construction of any works which could have influenced it, have already been stated. The construction

of jetties will tend to check this advance for some years, becau
jetties near their shore-ends will form large triangular reservo
receive the sand moved toward them. On the other hand, some
sand scoured from between the jetties will be dropped beyon
outer ends, thus promoting bar advance. How far for some year
opposite tendencies will balance each other in affecting the p
rate of bar advance can best be learned by experience. Since t
vance existed prior to any works, it will ultimately exist afte
construction.

10. CROSS-SECTION OF JETTIES.

An examination of the existing south jetty by the Board showe
the stones near its shore-end had become considerably consolidat
tightened by the growth of marine animals and the accumula
sand. The same result is expected for additional stone-work bel
water, especially at the shore-ends.

The following is in general terms the cross-section of the pr
jetties. It should be modified in details when experience acqui
this unstable bottom shows it to be necessary. In the shoal wat
very possible that it may be somewhat reduced. (From the bar
24-foot curve it may be necessary to protect the foundation by
of heavier stones, and this is included in the estimate.) Top of
to be 5 feet above low water, but to slope to level of ground a
inner ends. Foundations to be a brush mattress, 3 feet thick, c
at once by 4 feet of rubble, with widths increasing from 60 fee
shore to 90 feet at bar and 100 feet beyond. Jetties to be 12 fee
on top, and of rubble-stone, with side slopes of 1 on 1 out to crest o
except for about 10,000 feet inside of crest, for which distance t
ble jetty is to be 22 feet wide at low-water level, and on this a co
mass 12 feet wide is to be constructed, reaching from 5 feet abo
water to 2 feet below. The rubble side slopes, from about 6 feet
outward, to consist of heavy stone blocks, whose weight at t
reaches 6 or 8 tons. From crest of bar to 30-foot curve jettie
concrete piers, their widths being 18 feet at crest of bar, 24 feet
foot curve and outside of it. These piers may be built either
crete in huge bags, as the breakwaters at New Haven, Englan
Aberdeen were built, or of concrete in large blocks; in either cas
topped with concrete in mass. Such a concrete pier at present
be cheaper than a rubble jetty protected by heavy concrete bloc
as it will be some years before they will be built, the question
be reconsidered in view of the prices then existing and of exp
then gained. The new south jetty should follow the existing
jetty in a general way to utilize most economically existing wo
lecting the shoalest side of any part of it for the new work the
avoiding abrupt changes of direction.

The order of construction should be: First, to complete the sou
to the crest of the bar; second, the same for the north jetty;
carry both to the 30-foot curve.

Since carrying the south jetty out to the bar will reduce consid
the water cross-section on the bar, the velocities and depths there
be somewhat increased by that jetty alone. When both jett
completed to the bar, there is reason to believe that they will
their full effect is produced, give depths about two-thirds of those
jetties carried to the 30-foot curve will give.

As the jetties will diminish the freedom of inflow at Galvesto
will tend slightly to enlarge the San Luis Pass. It should there
watched.

The estimated cost of these jetties out to the crest of the bar is $3,000,000, and this amount will probably give two-thirds of the depths that jetties carried to the 30-foot curve would give.

The estimated cost of jetties completed to the 30-foot curve is $7,000,000, their aggregate length being nearly 54,000 feet. This estimate supposes that the money is freely supplied.

Respectfully submitted.

J. C. DUANE,
Colonel, Corps of Engineers, and Bvt. Brig. Gen., U. S. A.
HENRY L. ABBOT,
Lieut. Col. of Engineers, Bvt. Brig. Gen., U. S. A.
C. B. COMSTOCK,
Lieut. Col. of Engineers, and Bvt. Brig. Gen.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

INCLOSURES.

A.—Major Mansfield's report of July 29, 1885, to the Chief of Engineers, covering a report from Mr. Ripley.

B.—Major Mansfield's report of November 17, 1885, to the Chief of Engineers, covering a report from Mr. Picton.

*Sheet No. 1.—Map of Galveston Harbor, showing proposed jetties.

*Sheet No. 2.—Comparative chart of Galveston Harbor for different dates.

*Sheet No. 3.—Sections of existing south jetty appertaining to A.

A.

REPORT OF MAJOR S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., July 29, 1885.

GENERAL: I have the honor to submit herein a report upon a recent examination made of the Galveston jetty by Assistant Engineer Ripley.

Mr. Ripley's report is so in detail and covers the subject so thoroughly that but little is left for me beyond transmitting it.

I wish to say, however, and it should be remembered, that the original profile of the jetty, and former cross-sections, with exceptions noted, were taken at the close of each day's work before any compression took place or any of the rock crest was disturbed. It was not unusual for the superintendent to report a subsidence of the work placed on previous days, sometimes as great a subsidence as 2 feet and more upon the crest, and this was not unexpected from the very nature of the construction.

Owing to the difficulty likely to attend the placing of the fourth (top course) course of mattresses, the third and fourth courses were placed together; first, the third course with just sufficient stone to sink it in place, then the fourth course, placing upon the latter the complement of stone intended for both mattresses. Much the larger proportion of this stone was laid along the crest with the expectation that the sea would distribute it upon the slopes.

With this extra weight of stone directly on the crest and the extra thickness given to the mattresses of these two courses along the axis, it is not surprising that considerable difference in height of jetty should be found to exist at the present time as compared with the height, and this difference is probably not greater than might b ably expected. How much of the total depression is due to t alone it is, of course, impossible to determine.

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*Omitted.—Published in House Ex. Doc. No. 85, Forty-ninth Congress, first session.

It was customary before laying a mattress to sound and depth and character of the bottom, and in laying the top c mattresses we invariably found the bottom and second cours and usually charged with sand, except perhaps on the imme face, and very little settlement thereof was noted.

If the inference is correct that these lower courses were fi sand and were therefore indestructible, the depression of the f must be accounted for either by the bodily settlement of the the almost total destruction of the top courses. Our present tion does not enable us to answer the question satisfactorily. abundant evidence furnished here that indicates clearly th settlement has taken place, and it occurs in almost ever taken, notably in sections Nos. 3, 5, 9, and 10, while a stu other sections furnishes no proof to the contrary. How mu depression of the crest is due to this cause is therefore indet

That the teredo has attacked and destroyed some of the br can scarcely be a doubt. It is not to be denied that this w sure destroyer of timber within its reach, and it is not a to deny that the brush which constitutes a large part of our has been injured where exposed to attack. Our expectation funds would be furnished in sufficient quantities to enable u the brush entirely from the attack of the teredo, and it is that this would readily have been accomplished. Wherever has been etablished above overflow the sand has heaped a preserved it; where the work was low the currents sweepin probably prevents the accumulation of sand upon the surfa possible, and even probable, that the bulk of the mattress wo pletely filled with sand, and while so filled is proof against th of the teredo. Our examination does not show anything to trary. The samples of brush were grappled up *from the surf* jetty, and may have been merely odds and ends that stuck u and above the stone, which is found everywhere, a solid cove the jetty; and as this brush has been there a period of tw years it is not to be wondered at that it should be thorough combed. If we were to dig down into the body of the jetty, isfied we would find the brush as sound as the day it was cut be the currents constantly sweeping the jetty expose fresh attack, and that by slow progression the jetty is wearing a such case it is merely a question of time when it will all have

As the teredo does not penetrate the wood while the bark destruction is therefore slow, for only at the butts and where is abraded can the worm make a lodgment.

That this brush, even if largely eaten up, has served its pu mirably, cannot be denied. It has furnished, I might say, the has served to hold the stone and sand in place and made th compact mass upon an insecure and uncertain foundation, wh produced results in channel depths that are most valuable and not be gainsaid.

It is to be regretted that this all-important question of how the loss in height of our jetty is due to the teredo could not factorily determined. In this connection, I cite from a rep

Government agent at the Aransas Pass work, just made to this office, under date of July 17, 1885:

> Yesterday I made a thorough examination of the jetty to see if the teredo had done any damage to the brush-work or piles. I found that they have attacked all the exposed piles, and have penetrated from 1 inch to 1½ inches. Of course I cannot tell whether they have reached the piles which are surrounded by brush or not. I found a few instances where they have attacked the brush, *very few*.

The only evidence of the action of waves and heavy seas upon our jetty that is apparent is a possibe shifting of the crest of the jetty from its axis, and is unimportant, except as a warning against the too liberal use of small stone upon the surface of the jetty near the water-level.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. H. C. RIPLEY, ASSISTANT ENGINEER.

GALVESTON, TEX., *July* 17, 1885.

COLONEL: I have the honor to make the following report relating to the examination of the south jetty, Galveston Harbor:

The examination occupied five days, from June 17 to 22, and the weather during each day was unexceptionally fine for the purpose. The accompanying drawing exhibits the results of the examination as far as it can be shown graphically.

Eleven cross-sections were taken at nearly equal distances throughout the whole length of the jetty, averaging about 2,000 feet apart; they were taken by stretching a line across the jetty at right angles to its axis, and sounding every 5 or 10 feet for a distance of 70 to 150 feet on either side of the axis. The profile was taken by zigzagging slowly across the jetty, and noting and locating the least soundings at each crossing. In this way the height of the crest was determined at eighty-seven places, averaging about 230 feet apart. The profile constructed from these soundings is shown on the drawing, together with a profile of the original bottom, or bottom at time of placing the foundation course, and a profile of the top of the jetty at the time of placing the upper course. From these we get the following results:

	Feet.
Average depth of bottom	8.88
Average depth of top at time of placing	0.16
Average depth of top at present time	4.68
Average height as completed	8.72
Average height at present	4.20

Average subsidence, 4.52, equal to 51.8 per cent.

Taken in sections of 5,000 feet, commencing at the outer end, we find the average subsidence to be as follows:

	Per cent.
0 feet to 5,000 feet = 5.96 feet equals	51.7
5,000 feet to 10,000 feet = 5.18 feet equals	52.3
10,000 feet to 15,000 feet = 5.05 feet equals	39.9
15,000 feet to 20,000 feet = 5.46 feet equals	80.1
20,000 feet to 22,551 feet = 1.36 feet equals	20.3

Cross-sections Nos. 1, 2, 3, and 4 were taken at points where previous sections had been taken, which are plotted together with an outline of the foundation-course mattresses as placed for the purpose of comparison. At the points where cross-sections Nos. 5 to 11 were taken no previous sections had been taken, but from the records of construction there has been plotted an outline of the foundation course and of the upper course as they were placed.

Observing the cross-sections in detail, it will be seen that at No. 1, on August 8, 1882, two sections were taken, one before and one after placing the third and fourth courses. These are shown in red ink. On December 2, 1882, another cross-section was taken at the same point, which is shown in blue ink. From these it will be seen

that from August 8, 1882, to December 2, 1882, there took place a subsidenc
in a period of about four months, which is at a rate of .25 of a foot per mo
from December 2, 1882, to June 17, 1885, there took place a maximum sub
4.8 feet in a period of about thirty months, which is at the rate of .16 of
month. It will be observed that the crest of the jetty lies to the north o
indicating that the stone which was placed in larger quantities along the
been washed towards the north. This movement of the crest of the je
north is observable in nearly every section, especially the outer ones. I
be noticed that the appearance of rock 7 feet on the north side and 10 fe
south side beyond the foundation course indicates that some and perhaps
able stone may have been washed entirely off of the jetty. At No. 2 tw
were taken October 21, 1882, one before and one after placing the third s
courses. The subsidence at this point from October 21, 1882, to June 18, 188
of about thirty-two months, is 7½ feet at the axis, which is at the rate of .2
per month; No. 3 shows a subsidence of 7.7 feet; No. 4, 9.2 feet; No. 5, 6.7
6, 3 feet; No. 7, 4 feet; No. 8, 3.8 feet; No. 9, 8.2 feet; No. 10, 4.5 feet, and
feet. At No. 11 it will be seen that the sand entirely envelopes the brush-
it is probable that the loss in height at that point is due alone to the leve
of the stone along the axis. Samples of brush and stone were grapple
the surface of the jetty at sections Nos. 3, 4, 5, 6, 7, 8, 9, and 10. The ston
ered with barnacles, moss, and some coral, but no oysters. The brush wa
covered, and with the addition of a very few small oysters on one sample
Sample at No. 3 was thoroughly honeycombed and abandoned. It was p
cember 23, 1882, and had therefore been in the jetty about 2½ years. Samp
was placed November 23, 1882, and was thoroughly honeycombed and a
Sample No. 6, placed January 10, 1883, was completely honeycombed and a
Sample No. 7, placed June 14, 1883, is a piece of oak with the bark still on ;
pretty thoroughly honeycombed, it still possessed considerable strengt
worms had evidently not finished with their work. Sample No. 8, placed
17, 1882, was thoroughly honeycombed and abandoned. Sample No. 9, pl
18, 1883, was thoroughly honeycombed and abandoned. Sample No. 10
piece of brush only slightly eaten by the worms. Although exposed to th
as is shown by its want of bark and accumulation of barnacles, yet they se
abandoned it after penetrating only a short distance. The other pieces of t
were thoroughly honeycombed.

The question naturally arises, What has been the nature of the subside
jetty? It must be admitted, I think, that this examination does not furn
pletely satisfactory answer. Section No. 5 shows an undoubted settlem
whole body of the jetty from the south side, to within 2 feet of the axi
distance of 43 feet from the edge. At this point the top of the jetty is
with the bottom at time of placing the foundation, and, in order that this
sult, some settlement must have extended still further and probably pass
the axis of the jetty. Allowing for a similar settlement on the north side,
subsidence may be accounted for alone by bodily settlement. At this poin
has a base of 90 feet. Section No. 3 shows an undoubted settlement of
body of the jetty from the south side to within 13 feet of the axis, or for
of 47 feet from the edge; in this case the south edge is 60 feet from the axis,
probable, therefore, that some settlement has extended beyond the axis, and
might reasonably conclude that at this point the entire subsidence is du
ment bodily. The same remarks are also applicable to sections Nos. 9 an
when we come to consider sections No. 1 or 2, it is not apparently probabl
jetty has settled bodily, and yet there is no proof to the contrary. On the o
that the worms have eaten off the brush composing the mattresses is certai
a compression is due to this cause is also certain. We also have evidence o
having been washed off of the jetty, and we cannot assert positively that
dence at Nos. 1 and 2 may not have resulted from the two causes combine
any bodily settlement. Hence it may be said that the results of this exam
not completely answer the question involved, for it does not enable us to
how much of the subsidence is due to the action of the sea and worms and
to bodily settlement.

Very respectfully, your obedient servant,

H C. RIPLEY,
Assistant

Bvt. Lieut. Col. S. M. MANSFIELD,
Corps of Engineers, U. S. A.

B.

REPORT OF MAJOR S. M. MANSFIELD, CORPS OF ENGINEERS.

United States Engineer Office,
Galveston, Tex., November 17, 1885.

General: Referring to the letter of the Board of Engineers of Auust 7, 1885, referred to me by indorsement, recommending that borings e made at numerous places along south jetty at Galveston, Tex., to determine, if possible, to what is due the apparent settlement of the jetty, have the honor to say that borings have been made to the extent of vailable funds, and the detailed report of Assistant Engineer Mr. J. I. Picton, who conducted the operations, is respectfully submitted herewith, and the letter of the Board is returned to your office.

Six borings were made on or near the axis of the jetty; two of them, Nos. 1 and 8, were near the outer end of the work, the portion longest n place and most exposed to the action of the sea. The boring nearest the shore was 3,084 feet from the inner end of the work, and the remaining borings were at intermediate points, and for ready reference are located upon a lithographic chart herewith.

The opinion I have arrived at from a study of the cross-sections at the etty made in June last by Mr. Ripley, that there was abundant evidence of a bodily settlement of the work, has been completely disproved by his examination, which shows that no bodily settlement of the jetty has occurred along or near its axis. The edges of the jetty have gone down with the washing out of the underlying sands, precisely as had been anticipated, and in these respects our original views upon the adopion of this system of brush mattress work for the construction of the Galveston jetty are fully confirmed.

It was originally thought that the brush, if used as a hearting to the work, would compress about 33 per cent., but our examination shows at the points of boring a loss in height of jetty of 61 per cent. It will be observed in boring No. 8 that the thickness of the foundation brush s found to be (12 feet—10.9 feet) 1.1 foot, the average thickness of the brush when placed being 1.5 foot, and the brush being found in sound condition, the loss is doubtless due to compression alone, and is about 33 per cent. This may be exceptional, and is so in reference to this examination, and therefore little value should be placed upon this circumstance. Indeed we find at boring No. 2 a thickness of foundation brush of only (5.9 feet—5.1 feet) 0.8 of a foot, which, compared with the original thickness, (1.5 feet, average), is a loss of 50 per cent. Here the foundation course of brush was exposed to the ravages of the worm from May 24, 1882, to February 20, 1883, before the second course of brush was placed thereon—a period of nine months.

At borings Nos. 1, 8, and 9 the upper work had been disturbed and broken by heavy seas soon after being put in place, and was repaired soon after by a deposit of riprap stone along the crest, and the results of the examination at these points, so far as making a characteristic showing of the whole jetty, may be somewhat affected in consequence.

It is well shown, I think, that where the brush is covered it has been preserved safe from the attacks of the teredo, and where samples of brush from the lower work shows signs of having been attacked and hen abandoned, it is clear the teredo has been destroyed therein by being covered by upper work and the accumulation of sand and shells.

The jetty seems to be a very compact mass of brush, stone, sh
sand, and is well covered upon its surface with stone having co
ing profusely, mingled with the oyster and other molluscous fo
It has been impossible from this examination to say how mu
loss of jetty height is due to each of the two causes of settleme
is evident that had the brush been properly protected from t
of the teredo, as it might have been had funds been provide
rapid and complete execution of the work, but little loss wo
to be ascribed to this cause. As it is, the bulk of our loss m
tributed to the teredo.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Major of Engineers,
Bvt. Lieut. Col., U

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. JOHN M. PICTON, ASSISTANT ENGINEER.

GALVESTON, TEX., *Novembe*

COLONEL: I have the honor to make the following report upon exa
south jetty at Galveston to ascertain cause or causes of its subsidence and
condition.

According to instructions contained in your letter of August 19, 1885, I ma
tions to commence work of boring into the jetty at various points alo
Assuming that the mattress work had not been entirely destroyed, it was
penetrate the work in the following manner: Three or four iron piles
driven into the jetty about 6 feet apart, a scaffolding erected upon the
moved from top of jetty inside of square or triangle by means of a diver,
cutting tools shaped somewhat like spades with cutting edges all a
brought into requisition and worked from scaffolding to cut through to
layer. Battens to serve as guides for the same to be lashed near crest
piles, and after the diver had removed débris, care to be observed in ex
material and noting depths from which it was taken.

BORING NO. 1.

For convenience of comparison the point selected for making first bor
Section No. 1 (Ripley's, made June, 1885), 581 feet from outer end and 1
of axis of jetty, where its base was 120 feet, and four courses of mattre
been placed. Three iron piles were driven into the jetty, 6 feet apart, a
erected upon them, battens placed and lashed, and after removal of sto
cutting tools were worked vigorously, but owing to the presence of sand
small stone throughout the brush work, they were found of no use for t
for which they were intended, so were abandoned. After working upon
August 26, September 3, 10, and 11, removing material with diver, and g
little in depth, owing to quicksand and fine shell, it was decided to try d
hasten it to completion. Before next favorable day the storm of 17th, 18t
September had filled excavation and stripped the piles, leaving them ben
Dynamite was used in small charges September 23, 27, and 28, when a d
feet mean low tide was reached, and nothing but sand and shell could be fo
inches below. This boring was then considered completed, the sand bot
been reached, and the results of the work at this point are as follows:

	Feet.
Depth on rock	7.1 me
Depth on upper brush-work or compacted mass, brush, fine shell, and sand	9.5 me
Depth on rock	11.5 me
Depth to sand bottom	11.6 me

Rock from crest of work was covered with small unoccupied oyster-shell
of pinkish and white coral; below sand and shell filling it was discolor
addition.

Brush-work had lost its identity as mattress-work throughout, but was stronger near crest, gradually growing weaker as depth of excavation increased, and one piece of brush was found occupied by teredo.

Cane was found in lower work, soft and with little strength, though free from signs of teredo.

Creosoted oak stakes in top of brush-work were damaged by worm at their tops only, the lower imbedded parts being sound.

Below level of sand and shell filling the jetty was a compact mass of sand, shell, stone, and brush in various stages of decomposition.

Referring to the records of placing, it is found that at this point the foundation course was laid December 23, 1881, second course January 19, 1882, and third and fourth courses August 8, 1882, and that, owing to some damage done to upper work, 287.95 cubic yards of riprap was distributed here over a length of jetty crest of 150 feet on October 9, 1882. The depth upon the sand bottom when foundation mattress was placed is found to be 11.8 feet mean low tide, upon ballast of foundation mattress 9.8 feet mean low tide, and upon upper rock at time of placing fourth course at this point a depth of 2 feet mean low tide (approximately).

A rock was found in this boring at a depth of 11.5 feet mean low tide, and although probing a few inches below failed to discover anything but sand and shell, still the location of the bottom of the jetty is not positive as at other bores, so no comparison for settlement of lower mattress is made. The depth upon top rock at point of boring upon placing of fourth course (2 feet mean low tide), compared with 7.1 feet mean low tide, the present depth, gives evidence of a loss in height of work at this point (7.1 feet — 2 feet = 5.1 feet) of 5.1 feet, or (5.1 feet ÷ 9.8 feet = .520) about 52 per cent of original elevation.

Use of dynamite was abandoned, owing to fear of disturbing work to such an extent that its condition could not be determined accurately.

BORING NO. 2.

This was located 7 feet north of axis and 19,467 feet from outer end of jetty, where its base is 60 feet and three courses of mattresses had been laid and through all of which it passed. On September 29 an iron pile was driven to mark point of boring and a triangle, formed by lashing three iron cutting-tools together, lowered down upon rock top of jetty (with one corner lashed to pile) to serve as guide for diver, when work of removing and examining material was commenced. Progress was slow, owing to great strength of ebb currents across the jetty, which dragged our barge anchors and against which diver could not stand. Work was continued September 30, October 1, and on October 3 the sand below the jetty was reached at a depth of 5.9 feet mean low tide. Probing 1 foot deeper failed to find aught but sand. At this point we have:

	Feet.
Depth on rock	2.6 at mean low tide.
Depth on brush (second course?)	4.2 at mean low tide.
Depth on sand and shell covering	4.4 at mean low tide.
Depth on brush foundation mattress	5.1 at mean low tide.
Depth to sand bottom or bottom of lower mattress	5.9 at mean low tide.

Rock on top of jetty was covered with brownish mossy slime and oysters (some few alive), but in body of work it was simply discolored with black slime.

Brush ends projecting above upper rock, though for most part abandoned, were well eaten by teredo to the point of entering sand and shell filling; below this plane the brush (pine) was strong, tough, and untouched by worm. Even the pine leaves were perfectly preserved, and what appeared to be sprouting cane was found at or near top of foundation mattress.

It was observed by diver that three layers each of brush and stone were passed through.

From the office records I find that at this point the foundation course of work was placed May 24, 1882; second course, February 20, 1883; and third course, April 28, 1883. Upon the said bottom at time of placing foundation mattress there was a depth of 6 feet mean low tide, and rock ballast of upper work at this point projected above plane of mean low tide 1.5 feet. Comparing height of work here in 1883 and the present time, a loss (2.6 feet + 1.5 feet = 4.1 feet) of 4.1 feet, or (4.1 feet ÷ 7.5 = .546) about 55 per cent. of original height, is evident; and a comparison of depths upon sand bottom now and at time of placing foundation mattress shows that no bodily settlement has taken place, the slight difference being no doubt due to crude manner of making borings.

BORING NO. 6.

Boring No. 6 was located on axis of jetty, 6,713 feet distant from its outer end and 23 feet shoreward from Section No. 4 (Ripley's), where base of work is 90 feet, and four courses of mattress were laid. The following data were obtained:

	Feet.
Depth on rock	8.4 at mean low tide.
Depth on rock, second course	9.6 at mean low tide.
Depth on brush, second course	10.1 at mean low tide.
Depth on sand and shell covering	10.1 at mean low tide.
Depth to sand bottom or bottom of lower mattress	11.8 at mean low tide.

The rock at this point was well covered with barnacles, oysters both dead and alive, some coral, and reddish discolorations. Coral was largest on second-course rock; and the softer sandstone, though free from attachments, showed evidences of perforation, as before mentioned.

Brush of upper work was weak, honeycombed, and abandoned, but that just below second-course rock was better and mostly unoccupied; lower brush was tough and sound, having only an end eaten now and then before teredo had abandoned its work. Below sand and shell filling it is practically uninjured.

The cane found in lower work was unhurt by worm, but had little strength.

Upon locating the depth of bottom of jetty a depth of 13.8 feet mean low tide was reached by probing without discovering more brush or stone.

From the records I find that the foundation course was placed here July 29, 1881; second course, June 29, 1882, and the third and fourth courses, December 17, 1883. The depth upon sand bottom at time of placing foundation-mattress was 11.4 feet mean low tide, which, by comparison with depth upon sand bottom at present (11.8 feet—11.4 feet=.4 foot), shows a bodily settlement of jetty of .4 of a foot. The depth upon the rock ballast of fourth course at this point, when placed, was 1 foot mean low tide (approximately). Making a comparison for subsidence of top rock, we find (8.4 feet—1 foot=7.4 feet) a loss in height of 7.4 feet, or (7.4÷10.4=.712) about 71 per cent. of original elevation.

BORING NO. 7.

This boring was made October 16 and 17, and was located 10,068½ feet from outer end and 8½ feet north of axis of jetty, where its base is 90 feet, and three courses of mattresses were laid.

It passed through foundation and third courses only, the former of which was easily traceable. From note-book the following is taken:

	Feet.
Depth on rock	5.4 at mean low tide.
Depth on foundation rock	6.6 at mean low tide.
Depth on foundation brush	7.2 at mean low tide.
Depth to sand and shell covering	7.1 at mean low tide.
Depth to sand bottom or bottom of lower mattress	8 at mean low tide.

Oysters, dead and alive, some coral and yellowish discolorations covered the rock removed from top of jetty; all rock below top of sand filling discolored black. More perforated sandstone was found here.

Upper layer brush was thin, honeycombed and weak, but that in foundation was strong, tough, and well preserved. The teredo had commenced but abandoned its work.

Cane was found at top of foundation-mattress untouched by worm, but soft and weak.

Reaching the bottom of jetty, probing to a depth of 9.2 feet, mean low tide, proved that nothing but sand was below.

Referring to the records it is found that foundation-mattress through which this boring passed was placed June 1, 1881, in a depth of 8.3 feet mean low tide (with the tide record of that day questioned as being in error); a comparison of the depths on sand bottom is not satisfactory, as it shows a less depth now than in 1881, which, no doubt, is attributable to the dubious tide record. The upper mattress at this point was placed July 23, 1881, but the depths upon its top is not given, so no comparison for subsidence of top of jetty can be given either at this point or near it.

BORING NO. 8.

This consumed October 24, 27, and 29, and was located 9½ feet north of axis and 598½ feet from outer end of jetty, where its base is 120 feet, and four courses of mattresses were laid, all of which were passed through in this boring. At th found—

	Feet.	
Depth on rock	7.8	at mean
Depth on upper brush	8.7	at mean
Depth on brush, second course	9	at mean
Depth on sand and shell covering	9	at mean
Depth on rock, foundation	10.1	at mean
Depth on brush, foundation	10.9	at mean
Depth sand bottom or bottom of lower mattress	12	at mean

The rock on top of jetty was more or less covered with oyster shell, small encrustation; that from lower work with oyster shell and barnacles, and black.

The upper brush on that of third and fourth courses was honeycombed doned, and had little strength; that of the second course was eaten by te the top only; and foundation-brush was well preserved, strong, and pra good as when placed.

Creosoted oak stakes were found in upper work well eaten from their to of entering the sand and shell filling. Below that plane they were soun touched by worm.

Cane was found between depths of 9 feet and 10.1 feet mean low tide (i the presence of second-course work), but was soft and weak.

A depth of 12.8 feet mean low tide was reached by probing in this boring foot below bottom of jetty.

According to the records of placing there was, depth upon the sand botto of placing foundation-mattress (December 23, 1881), of 11.8 feet mean low ti compared with depth at present time, gives a settlement of .2 of a foot at t The second course was placed January 19, 1882, and the third and fourth c gust 12, 1882, with a depth upon upper rock at this point of 2 feet mean low proximately); this depth, compared with present depth (7.8 feet — 2 feet shows a loss in height here of 5.8 feet or (5.8 feet ÷ 9.8 feet = .592) 59 per cen work. Records also show the placing of 287.95 cubic yards riprap along jetty crest here, to repair damage done to upper work on October 9, 1882.

BORING NO. 9.

Boring No. 9 was only partly completed and consumed October 30, Novem part of November 3. Its location is 3 feet north of axis and 2,522 feet from of jetty where base is 120 feet, and four courses of mattresses were laid. tained the following:

	Feet.	
Depth on rock	8.7	at mean
Depth on upper brush	9.1	at mean
Depth on sand and shell covering	9.5	at mean
Depth on brush, second course (?)	9.6	at mean
Depth on rock (foundation course?)	10.5	at mean
Depth on brush (foundation course?)	11.1	at mean

The rock at this point was covered with barnacles, oyster shells, coral, re yellowish discolorations and encrustation in upper work, but lower down h few barnacles and oyster shells attached.

The upper brush was better and stronger than before found so near to though it was well wormed and partly occupied by teredo; below the lev and shell filling it was damaged very little, and for the most part was in an state of preservation.

From the records it is found that the depth upon the sand bottom at time foundation-mattress was 11.6 feet mean low tide, but as the bottom of the not located in this boring no comparison for settlement can be made. The d rock of fourth course at time of placing is not given in the records, but at t point of sounding, 207 feet west of this boring, it is found to have been 2¼ low tide (approximately); and assuming height of work to have been the (which is probable), and making a comparison for subsidence of top of w 2.25 = 6.45) we find a loss of 6.45 feet or (6.45 ÷ 9.35 = .69) about 69 per cent nal height of work at this point.

The foundation-course was placed October 31, 1881; second course, Fe 1882, and third and fourth courses, October 26, 1882; and, owing to damaged u on November 14, 1882, 123 cubic yards of riprap was distributed over a len feet of jetty crest to repair the same.

Examinations were made to determine positions of south mattresses at sections Nos. 1, 3, and 4, and are reported upon in borings Nos. 3, 4, and 5. The following indicates the position of the south mattress at section No. 5, and gives results of a further investigation at section No. 1. The mattress at former place was found covered with sand, and, probing with force-pump nozzle attached to a sounding pole, I found—

On section line, 27 feet south of axis: Depth mean low tide 14 feet, hard sand; 17.7 feet, rock.

On section line, 32 feet south of axis: Depth mean low tide 14½ feet, hard sand; 17.5 feet, rock.

On section line, 40 feet south of axis: Depth mean low tide 15.2 feet, soft sand; 17.5 feet, rock.

Comparing this with the position of mattress when placed (see section No. 5, Ripley's) it is evident that a settlement of about 10½ feet and a sand filling of from 2 to 3 feet has taken place.

At section No. 1 rock could not be felt beyond a point 34 feet south of axis of jetty, and probing into sand failed to find either brush or rock of south mattress here. At this point I had—

On section line, 40 feet south of axis: Depth mean low tide 16.6 feet, sand; no rock or brush 21 feet.

On section line, 36 feet south of axis: Depth mean low tide 15.9 feet, sand; no rock or brush 21 feet; which shows that this mattress must either have settled a great deal or been carried away.

The following is a résumé of contents of reports upon borings on or near axis of jetty:

Boring.	Distance north from axis.	Distance from outer end of jetty.	Bodily settlement.	Subsidence of top of work.	Original thickness of work.	Loss in height, per cent., of original work.
	Feet.	*Feet.*		*Feet.*	*Feet.*	
No. 1	10	581		5.1	9.8	.520
No. 2	7	19,467	+.1	4.1	7.5	.546
No. 6	0	6,713	−.4	7.4	10.4	.712
No. 7	8½	10,068½	+.3			
No. 8	9½	598½	−.2	5.8	9.8	.592
No. 9	3	2,522		6.45	9.35	.690
Mean			.6− .4= .2÷4=.05 foot.	28.85÷5= 5.77 feet	46.85÷5 =9.37 feet	3.060÷5= .612 per cent.

It will be seen from above table that four borings give us an average settlement bodily of .05 of a foot, five give a mean subsidence of top of 5.77 feet of work of average height of 9.37 feet, or an average loss of .612 per centum of original height of work at points of boring.

At borings Nos. 1, 8, and 9 the upper work is known to have been damaged, but only at No. 1 was more rock than usual noticed upon top of jetty. At point of greatest loss, boring No. 6, one year and a half elapsed between the placing of second and third and fourth course work, which may account for loss above the average.

The sand and shell only partly filled the work, but the condition of the brush above and below its top proves beyond doubt that where covered it will be well preserved and safe from attacks of teredo. It was noticed that to a great deal of this sand and shell filling was added the shell left in wood by teredo, proving, I think, a considerable destruction of upper uncovered work. The loss in height of jetty shown by these borings is greater than the actual loss, as it was found that the greater part of upper rock had been driven north of its axis, as shown by Mr. Ripley. In the lower and sound work it was not difficult to trace the courses laid, but near the top of jetty it was impossible to do so, and consequently some reliance had to be placed upon statements of diver.

In the accompanying diagram all the borings are shown, the layers of work as placed and as found by me being placed side by side for comparison. Boring No. 1 was not entirely satisfactory for some inexplicable reason, but leaving that aside all the foundation brush on or near axis is perfectly preserved and sound, and in many cases the second course also.

The percentage of loss in height due to teredo cannot be given, as it is not possible from this examination to separate the subsidence due to destruction of brush from that due to compression. Nor can the exact compression be determined, owing to likelihood of missing rock upon foundation mattress and the variation of depths taken upon the uneven surface of stone; hence the apparent lack of reliable data.

Although practically no settlement has taken place along jetty axis, it may be seen, by reference to borings Nos. 3, 4, and 5 on diagram, that considerable has taken place upon its edges.

Coral has formed upon nearly all of the top rock and some (of which yo
ples) has attained quite a growth for the short time the insect has been at
ters have attached themselves to the rock, but few are now alive. I am u
count for perforations of rock, as it was not inhabited, except by very
when brought up.

CONCLUSIONS.

As to the causes of the loss in height of the south jetty, it is my opini
are two in number only, destruction of unprotected upper work by tere
pression; bodily settlement does not enter into the question. Just how
due to each of these causes this examination fails to decide, but it is
from the sound condition of the lower brush-work and unsound conditi
work that more is due to destruction of upper brush by teredo than to c

Very respectfully, your obedient servant,

John M. P
United States Assistant

Maj. S. M. Mansfield,
Corps of Engineers, U. S. A.

S 2.

IMPROVEMENT OF SHIP-CHANNEL IN GALVESTON BAY, T

Original estimate (for channel 100 feet wide and 12 feet deep), 1877 ....
Appropriated, 1872 to 1886* ....

ORIGINAL CONDITION OF THE LOCALITY.

In 1871 the natural channel through the bay had a depth o
than 7 feet at the shoalest places, the average depth 8½ feet,
tom of soft mud, sand and shells.

PROJECT FOR IMPROVEMENT.

Estimate of 1877 (modifying that of 1871) was $446,326.42,
sum it was proposed to deepen and widen the channel from t
Bolivar Channel to the cut through Morgan's Point, to affo
nel 12 feet deep at mean low tide, with a width at bottom of

OPERATIONS PRIOR TO JUNE 30, 1886.

During 1872, 1873, 1874, 1875, and 1876, in 1879 and 1889,
and 1883, by contract and by Government machinery, dre
carried on through Red Fish Bar and in the lower and uppe
work resulting in a navigable channel of 8.9 feet at mean low
Bolivar channel to Morgan's Cut. The amount of money e
this work was 286,629.50.

No work has been done since 1883, owing to the reserv
available funds for Congressional action, "because of the
that the improvement demanded could not be made a perma
any reasonable cost; that the cost of maintenance would be
excessive; that the necessity for the channel was far less tha
and that it was not called for in the interests of commerce fo
ent."

It was provided in the act of July 5, 1884, that the mone
should not be expended until the Secretary of War be satisfie
Buffalo Bayou Ship-Channel Company has relinquished or ab

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* Last appropriation, 1882.

the United States forever all the franchises and any and all right to collect or impose tolls or charges from any part of said ship-channel or Buffalo Bayou.

The views suggested in letter of August 7, 1884, Office of the Chief of Engineers, viz, to call upon the stockholders of the Buffalo Bayou Ship-Channel Company for their consent to the surrender and transfer of their charter, &c., to the United States, were complied with by letter from this office August 13, 1884. On the 14th of October, 1884, Mr. Cave, the president of the company, in reply, stated that the matter was having full consideration. Since then nothing has been heard of the matter, and, in so far as this office is concerned, the subject remains in abeyance.

PROBABLE OPERATIONS OF THE YEAR ENDING JUNE 30, 1887.

The action of Congress upon this work in the pending river and harbor bill will decide active or inactive operations for the year.

The work is in the collection district of Galveston. The light-houses on or near the line of work are at Bolivar Point, at Fort Point, at Half Moon Shoal, at Red Fish Bar.

COMMERCIAL STATISTICS.

The commercial statistics are to be found with the report of the improvement of Buffalo Bayou, Texas.

Money statement.

July 1, 1885, amount available	$159,870 50
July 1, 1886, amount available	159,870 50

S 3.

IMPROVEMENT OF TRINITY RIVER, TEXAS.

Estimate of 1880, dredging bar and removing snags above and below Liberty, and dredging bar at the mouth of Middle Pass	$36,541
Appropriated 1880–1886	*22,000
Balance of estimate	14,541

ORIGINAL CONDITION OF THE LOCALITY.

In 1879 the river above Liberty, the head of tide water, 41 miles from its mouth, was a succession of rock and gravel shoals, with deep pools between, very tortuous, and obstructed by water-logged snags, which were not carried off during high stages of river. Below Liberty the character of the river was entirely different. Between Liberty and Moss Bluff it varied in width from 200 to 275 feet and in depth from 5 to 30 feet, with the exception of a bar, with 2 feet water over it, 4½ miles below Liberty. From Moss Bluff to the mouth of the river it opened out to 500 feet in width and a depth of from 10 to 45 feet, free from any obstruction. It flowed into Galveston Bay through four principal channels and a number of small bayous. About 4½ feet could be carried across the bar at the mouth of the river in the best natural channel.

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*Appropriated 1878, 1879, $12,500, making a total of $34,500 appropriated 1878–1886.

PROJECT FOR IMPROVEMENT.

The estimate of 1871–'73 was $46,000 for pile breakwater, dr
removing snags, &c., to secure a channel for navigation of 5 feet
from the mouth up to Liberty.

OPERATIONS FROM 1880 TO JUNE 30, 1885.

1. *Contracts with Seth N. Kimble, of June* 10 *and November* 14,
Forty-seven thousand three hundred cubic yards of material
moved from the entrance bar, leaving a dredged channel of
than 5½ feet depth, averaging 110 feet width, and in length ac
bar 4,800 feet. Work done in June and July, 1880.

2. *Contract with G. L. Long, of July* 25, 1881.—Two thous
hundred cubic yards of sand were removed in making a cut 85
and 7 feet deep through a bar located about 4 miles below Liber
33 snags and 25 overhanging trees were removed and the river c
other obstructions for that portion between its mouth and
Work done in April, 1882.

3. *Contract with John J. Atkinson, of October* 15, 1884.—A s
revetment was built across the bar at the mouth of Middle Pa
channel dredged alongside of it. The length of revetment w
feet, its top in a plane 4½ feet above the surface of mean low ti
dredging amounted to 23,275 cubic yards, the material being
torily disposed of behind the revetment and in other suitabl
Work was done between November, 1884, and April, 1885.

The amount expended upon these improvements, including
tendence and contingencies of office, was $33,993.50, and res
temporarily opening the river to navigation so as to admit ve
feet draught.

No funds were available, and work of improvement did not
through any part of the last fiscal year. The condition of the
ment at the end of the year (June 30, 1886) was about the san
ported last year, with the exception that the revetment receiv
damage along the upper wing where open to scour and he
No complaint is made of want of depth of water in channel, a
appearances the demands of commerce and navigation, for a
least, have been satisfied.

PROBABLE OPERATIONS OF THE YEAR ENDING JUNE 30,

There being no adequate funds available, no work is possibl
the year.

The balance of the estimate of 1880, $14,541, could be profi
pended in the fiscal year ending June 30, 1888, in continuing
improvement originally intended.

There exists no basis for estimating the length of time the c
through the bar at the mouth and the bar at Liberty will rem
for navigation, or of the cost of maintaining the river from i
to Liberty in a navigable condition.

The work is located in the collection district of Galveston. Nearest
Red Fish Bar, Galveston Bay.

COMMERCIAL STATISTICS.

Commerce is small, and consists of cord-wood and charcoal
saw-logs and timber. One or two small mills are located on th

Money statement.

July 1, 1885, amount available	$506 50
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	194 85
July 1, 1886, amount available	311 65
Amount (estimated) required for completion of existing project	14,451 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	14,451 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

S 4.

IMPROVEMENT OF BUFFALO BAYOU, TEXAS.

Estimate of 1880, for channel 100 feet wide and 12 feet deep, between Simm's and White Oak bayous	$385,299 75
Appropriated, 1881–'86	100,000 00
Balance of estimate	285,299 75

ORIGINAL CONDITION OF LOCALITY.

The bayou, a tide-water stream emptying into the San Jacinto River at Lynchburg, about 25 miles from Houston, was, in 1880, only navigable for vessels of 6 feet draught below Houston. For 3 or 4 miles below White Oak Bayou the banks ranged from 20 to 45 feet in height, and at points were very bluff, with a tendency to caving during high water. The narrowness and tortuousness of the bayou for this distance, with its sharp bends, were the most serious obstructions to its navigation.

PROJECT FOR IMPROVEMENT.

To increase the navigable capacity of the stream it was proposed to do dredging and snagging and to remove overhanging trees, &c., the estimate for a channel 100 feet wide and 12 feet deep between Houston and Clinton embracing the following: 1,313,130 cubic yards of dredging, 7,900 linear feet of sheet-piling, and 11.2 miles overhanging trees.

Twenty-five thousand dollars were appropriated March 3, 1881, and made applicable "to secure a channel of 100 feet."

OPERATIONS FROM 1882 TO JUNE 30, 1885.

1. *Contract with G. L. Long, of September* 1, 1881.—Overhanging trees removed for a distance of 11.2 miles of bank; 98,910 cubic yards of material removed from bed of the stream.

2. *Contract with John J. Atkinson, of November* 11, 1882.—Overhanging trees, underbrush, &c., were removed from 1,247,810 square feet of bank; 153,708 cubic yards of material, and 1,350 logs and stumps were removed from shoal and narrow places on the bayou.

3. *Contract with Rittenhouse Moore, of September* 12, 1884 (not completed June 30, 1885).—Seventy-eight thousand six hundred cubic yards of material removed from shoal and narrow places in the bayou, and 277 stumps, logs, &c., extracted from the bed of the stream.

The amount expended in carrying on this work was $95,522.13, which resulted in developing an improved channel along the bayou to an extent much appreciated by the commerce thereon.

PROGRESS MADE DURING THE YEAR ENDING JUNE 30,

In the early part of August Mr. Rittenhouse Moore comp
contract; the work during July and August adding to his
operations the removal of 13,500 cubic yards of earth, &c., an
traction of 26 stumps and logs. The contract was satisfact
formed. It covered in the aggregate 92,100 cubic yards of
and the removal of 303 logs and stumps, and thereby impr
channel for navigation to that extent.

Cost of this work (paid contractor), $22,001.10.

The object of this contract was to do such dredging and sn
the limited funds available would warrant, with the expec
reaching the condition of a complete and permanent improven
time in the future, and after a sufficient amount of money sh
propriated and expended.

The work accomplished from 1882 to 1886 is such as confirn
lief that the improved channel of 100 feet by 12 feet can be ol
a reasonable time and at a reasonable cost if funds be granted
to time sufficient for steady progress toward the object aimed

PROBABLE OPERATIONS OF THE YEAR ENDING JUNE 30

The work (if any) will follow that already done. The bulk
ble funds will be expended in dredging at certain points wher
rowness of the channel requires relief—especially of the ben
fore partially worked over. An estimate of the year's work
$25,000=80,000 cubic yards of dredging and the removal of 50

During the fiscal year ending June 30, 1888, there could be
expended $100,000 (the annual estimate) in continuing work of
ment by dredging, snagging, &c., in conformity with original

The work is in the collection district of Galveston, and th
light-houses are those in Galveston Bay and at the entrance t
ton Harbor, Texas.

Money statement.

July 1, 1885, amount available ....
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885 ....

July 1, 1886, amount available..
Amount appropriated by act approved August 5, 1886..................

Amount available for fiscal year ending June 30, 1887.................

Amount (estimated) required for completion of existing project........
Amount that can be profitably expended in fiscal year ending June 30, 1888
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

OFFICE OF THE HOUSTON DIRECT NAVIGATION COMP
Houston, July

Statement of freight carried by Houston Direct Navigation Company f
ending May 31, 1886:

Cotton, 197,518 bales..
Merchandise..
Railroad iron...

	Pounds.
ber	1,025,772
	1,021,854
l	9,105,600
pipe	631,680
on-seed cake	31,185,280
Total	159,780,450

L. MEGGET,
Secretary.

S 5.

IMPROVEMENT OF THE MOUTH OF BRAZOS RIVER, TEXAS.

mate for jetties, 1880	$522,890 44
ropriated, 1880–'86	140,000 00
Balance of estimate	382,890 44

ORIGINAL CONDITION OF THE LOCALITY.

he river debouches into the Gulf of Mexico through a single natural let and preserves a nearly uniform width and depth from the coast several miles up-stream, the width averaging from 500 to 600 feet, depth from 15 to 18 feet. The bed of the river is soft mud; the ks, except at a few points, being above overflow. A bar had formed he mouth of sand drifted along the shore and driven in by the sea. he crest of the bar was about three-eighths of a mile from the shore- , and the channel across afforded a variable depth of water for igation of, at times, not over 8 feet (in October, 1874 only 2½ to 3), being subjected to changes due to winds, tide, and stages of water iver.

PROJECT FOR IMPROVEMENT OF THE BAR-CHANNEL.

he project was originally adopted in 1880, and looked to the ameli- tion of the channel over the bar by the use of jetties, the positions the jetties to be determined by the local engineer upon the general nciple that they should be parallel, or nearly so, that they should ninate in 18 or 20 feet water, and that their position be so chosen as x the channel in its natural direction. Approximate length of north y, 3,600 feet; of south jetty, 4,350 feet. Estimated cost, $522,890.44.

OPERATIONS FROM 1880 TO JUNE 30, 1885.

orth jetty.—This work was built out from shore a total length of 33 feet, the inner portion for some 600 feet near shore-line being sed above the plane of high water, the outer portion being sub- rged an average of 4 feet below level of mean low tide.

outh jetty.—This work was extended 700 feet, a foundation course mattresses commencing at a point 2,000 feet distant from shore run- g on a curve to the eastward, leaving the distance between the jet- 720 feet.

he jetties were constructed of brush mattresses and concrete ballast, 9,654.47 having been expended in the operation. The result of this enditure has caused the channel to be improved both in direction and depth, and in every way sufficient for the coasting trade ha lation with the port.

No funds were available for the past fiscal year, and no work w

PROBABLE OPERATIONS OF THE YEAR ENDING JUNE 30,

Eighteen thousand seven hundred and fifty dollars will en placing of about 5,000 cubic yards of material in the work. To work in running out top course of north jetty and making mino to old work it is estimated that 1,750 tons of concrete and 5, yards of brush-work may be placed, which will in a measure jetty proportions and tend to keep the improvement from deter

During the fiscal year ending June 30, 1888, there could be p expended $100,000 (the annual estimate) in continuing jetty tion in accordance with the adopted plan.

The work is located in the collection district of Galveston, and the nea house is at the entrance to Galveston Harbor.

COMMERCIAL STATISTICS.

No reliable statistics can be furnished. The commerce of this river tha and from the Gulf is insignificant.

Money statement.

July 1, 1885, amount available..
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885..

July 1, 1886, amount available..
Amount appropriated by act approved August 5, 1886....................

Amount available for fiscal year ending June 30, 1887.....................

Amount (estimated) required for completion of existing project.........
Amount that can be profitably expended in fiscal year ended June 30, 1888
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

S 6.

IMPROVEMENT OF PASS CAVALLO, INLET TO MATAGORDA BAY

Estimate, south jetty and groins for shore protection, 1879...............
Appropriated, 1876-'86...

Balance of estimate..

ORIGINAL CONDITION OF THE LOCALITY.

The pass forms the connection between the Gulf of Mexic large inland basin (approximate area 520 square miles), co Matagorda Bay, Espiritu Santo Bay, San Antonio Bay, and n small bays further inland and connecting with these. Its hist that of other entrances on this coast, showed a steady deteriora harbor and a constant shifting of the channel to the south and we bar, composed of loose shifting sand and fully exposed to the storms, permitted entrance of vessels drawing not more than 8 feet, the ever-varying channel having a depth of from 7 to 9 feet.

PROJECT FOR IMPROVEMENT.

To extend one jetty from the head of Matagorda Island, in a southeasterly direction, and construct groins for shore protection whenever necessary, jetty and groins to be of brush-mattress work, ballasted with concrete and stone. Object of work, to obtain a 12-foot channel across the bar. Estimated cost, $1,039,280.

OPERATIONS FROM 1880 TO JUNE 30, 1885.

South jetty.—This structure, on the 30th of June, 1885, had in its foundation and superposed courses 48,934.53 cubic yards of brush mattresses and concrete and stone ballast, the total length of which approximated 5,253 feet. About 1,400 feet of the shore end was raised above mean low tide, the remaining 3,853 feet of jetty being submerged. The work followed that outlined in approved project. Amount expended upon this work to June 30, 1885, was, including superintendence and contingencies, $267,816.95, and resulted in giving the channel permanency in position, together with a decided improvement in depth across the bar in a direction suitable for navigation.

PROGRESS MADE DURING THE YEAR ENDING JUNE 30, 1886.

An extension of time for completing the contract of September 6, 1884, with A. M. Shannon & Co., had been granted by the Chief of Engineers to September 30, 1885. By the 28th of July the contractors had completed their work, having added to jetty 4,027,636 cubic yards of brush mattress work and 1,131.5 tons of stone ballast. The work was satisfactorily performed. It consisted in placing an aggregate of 14,566,616 cubic yards of brush and stone in the jetty at a total cost of $47,851.97 (paid contractors), or $3.28½ per cubic yard.

The object of this work looked to giving the south jetty (the only work) larger proportion, with a view to throwing a more concentrated outward current upon a limited extent of bar to develop a deeper channel thereon, and incidentally, by further work as appropriations are made available, slowly approach the consummation of the desired improvement.

For the reason that the funds remaining in hand, after the completion of A. M. Shannon & Co.'s contract, July 28, were the residue applicable to superintendence and contingencies of office, no work was done the rest of the year.

PROBABLE OPERATIONS OF THE YEAR ENDING JUNE 30, 1887.

The present jetty work, although incomplete in lengh and height for permanent improvement, strengthens the expectation of a thorough improvement when the jetty reaches proportions necessary to that end. Fifty thousand dollars will cover the cost of 15,000 yards of brush and stone work in the jetty; successive layers to raise the work to a higher plane. An examination prior to rendering project for continuing this improvement will be made, so that the money may be expended in the most profitable manner upon a basis conforming in a measure with the funds granted by Congress for this work.

During the fiscal year ending June 30, 1888, there could be p expended $200,000 (the annual estimate) in continuing the b the south jetty in accordance with the approved plan.

The work is located in the collection district of Indianola, Tex., and gorda light-house.

Money statement.

July 1, 1885, amount available ....
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885 ....

July 1, 1886, amount available ....
Amount appropriated by act approved August 5, 1886 ....

Amount available for fiscal year ending June 30, 1887 ....

Amount (estimated) required for completion of existing project 1,
Amount that can be profitably expended in fiscal year ending June 30, 1888 ....
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, INDIANOLA, T
Collector's Office, July

DEAR SIR: In answer to yours of July 5, 1886, will say that there were entrances or clearances for the fiscal year ending June 30, 1886.

There were ten entrances of steamships and two of schooners coastwis period, aggregating 7,519.17 tons; no clearances.

The present business of this district is done at Eagle Pass and Del Rio, Grande, as the arbitrary rates charged on freights by rail to the interio port prevents water transportation to this place. This action on the part road officials tends to injure and will finally destroy every port on the coa if not stopped by legislation, as the bent of all railroads is to get the long

Hoping this information, small in itself, is what you desire,

I remain, yours, &c.,

OTTO L. THREE

Maj. S. M. MANSFIELD.

S 7.

IMPROVEMENT OF ARANSAS PASS AND BAY UP TO ROCKPORT PUS CHRISTI, TEXAS.

Estimate for jetties, groins, shore protection, &c., 1879 ....
Estimate for dredging, &c., in the bay, 1879 ....

1,

Appropriated, 1879–1886 ....

Balance of estimate ....

ORIGINAL CONDITION OF LOCALITY.

The pass forms connection between the Gulf of Mexico and and Corpus Christi bays, and its history, like other entranc coast, shows a constant movement of its channel to the south, gressive shoaling therein and enlargement of the Gulf Bar, wh posed of fine shifting sand, &c., crowns the entrance at a d about three-fourths of a mile from shore. Across the bar during the year preceding the commencement of the work of improvement the best water available for navigation was 5 to 5½ feet, and this in a channel constantly changing its position. In the interior channels the depth afforded for navigation up to Rockport and Corpus Christi was about 8 feet.

PROJECT FOR IMPROVEMENT.

To extend jetties from the south end of Saint Joseph's Island and the north end of Mustang Island, contracting the width of water-way out to a sufficient distance to afford a draught of 12 feet at mean low tide over the bar, and to construct groins, in conjunction with a beach flooring of mattresses, for the protection of the head of Mustang Island up to and beyond Turtle Cove, and to plant trees upon Saint Joseph's Island for its protection against abrasion by winds.

Estimated cost of jetties, groins, &c., $759,185.

In the matter of improving the interior channels for navigation from Aransas Pass up to Rockport and Corpus Christi, the discussion of the problem was left to wait upon the protection of the islands from abrasion and upon the success of the attempt to increase the depth over the bar to 12 feet.

(Estimated cost, Major Howell, 1879, $441,537.75.)

OPERATIONS FROM 1880 TO JUNE 30, 1885.

1. *Protecting head of Mustang Island up to and beyond Turtle Cove.*—This was effected by the construction of seven groin-jetties, built on the west side of the pass, with a breakwater and revetment along the channel-face of Mustang Island.

2. *Protecting channel from drifting sand.*—This by means of a number of sand-fences built on Saint Joseph's and Mustang Island.

3. *Sustaining outward current for effective work in bar-channel.*—This was being accomplished by the construction of a jetty on the south side of the channel, running from Mustang Island into the Gulf in an easterly direction. The total length of this jetty was 5,500 feet, of which 1,500 feet was shore-work and 4,000 feet jetty-work proper. From extreme inshore end the work was raised above overflow by ordinary high tides for a distance seaward of 3,300 feet, the outer 2,200 feet being submerged 3 to 14 feet below mean low-water level, or 7 feet on an average.

The groins, breakwater, revetment, and jetty were constructed of brush mattresses and stone ballast. The high portion of jetty—inshore superstructure—was obtained mainly by a pile system and stone topping, and was merely intended as a temporary structure to catch and hold the drift-sand until such time as the money in hand would warrant the making of such structure more substantial. The amount expended, including contingencies and superintendence, to June 30, 1885, was $383,025.82, of which amount $9,938.93 was subscribed by private parties. The resulting effect of this expenditure was the securing of the head of Mustang Island and the developing of a good straight channel across the bar, carrying a depth of 11 feet at mean low tide.

PROGRESS MADE DURING THE YEAR ENDING JUNE 30, 1886.

The only available funds in hand July 1, 1885, were those left from the appropriation of July 5, 1884, amounting to $6,913.11. This sum was held in reserve to be applied to the preservation of the work by

supplying deficiencies and losses which might occur from ti
through the action of the sea, and in making any needed re
also for contingencies of office and care of plant.

In the latter part of August it was discovered that certai
the outer end of the finished work had become weakened by
of the teredo. It was considered advisable to replace the wea
sound ones (square timber charred and tarred) and to furth
the work by additional stone. Preparation was made, work
by hired labor and open purchase, and work of repair comm
last week in the month, and was continued until the 16th of S
at which time the outer end of the superstructured work was
headed and secured against, as it was thought then, even a
ordinary storm. It was expected that this work of repair
tinue until all the weakened piles found further inward would
by sound ones; but on the 17th, and during the 18th and 19
tember the severity of the weather hindered all work, and
worse, damaged the jetty to quite an extent. The following is
from the report of Mr. C. H. Butts, United States overseer,
tember 24, 1885, and is given so that a better understanding
circumstances connected with the damage and loss may be k

The wind blew fresh from the northeast all day on the 17th, getting
sea. The following night the wind and sea increased very much, so that
ing of the 18th the seas were breaking over the jetty from end to end.
the pile-driver, with two men, by using a coil of ratline for a life-line.
if anything more could be done to secure the pile-driver from being thro
waves. At that time the jetty, both pile-drivers, and everything seem
to stand any storm, though the sea was very rough and the wind blew
gale. All of that day the wind increased, the seas became heavier, and t
but just before dark I could see the jetty was undisturbed, and the pil
moved. All night the wind blew furiously, but its greatest violence w
till 2 a. m. of the 19th. During this time the force of the storm was ve
tide rose to a height of 4.7 feet above mean low tide by the bench-mark
station.

On the morning of the 19th I discovered that the top course of the jett
ried away. The new piles that I had just driven, as well as the old ones,
off, and piles, plank, and brush blown ashore.

Before the storm the shore on the south side had built out to Station
high tide. It was almost as high as the brush-work as far out as Stati
was covered with dry drifting sand. As far out as Station No. 1 the sand
as the top of the plank, or 2 feet higher than the brush-work. I had
down closely to the brush, spiking all anew; had stowed the stone in t
ner possible; but all was of no avail; it was carried away as far back
I had for drawing over the shore work.

The force of the wind was so great that a schooner with two anchors
channel between here and the light-house was driven away down the fla
west direction, between Mustang and Harbor Island.

The wreck Mary, supposed to be down to the clay, was settled 2½ or 3 fe
to the north.

The loss in height of jetty appeared to have no detrimental
the bar-channel. A slight change in direction, causing the
move their range a little to the southward, resulted, the dee
nel for navigation being found very close to the jetty immedia
the storm.

As a barrier to the sweeping of vast quantities of sand into
nel from Saint Joseph's Island, a small force was employed, in
in planting salt cedar—two rows of plants, extending from
to the point of the island. This was in accordance with ado
approved project, and was done then because of it being the
the year for planting cedars so as to assure of proper growth.

A recent examination shows that the settlement of the jetty
pression or undermining, or by action of the teredo, has ce

that the foundation is secure and permanent. From the shore-line of mean low tide the seaward portion of the work is entirely submerged, ranging from a depth of 1 foot at in-shore end to 3 feet at a point some 300 feet west of the Mary; the remaining outward extension being in about the same condition as reported last year, viz, submerged 3 to 14 feet, the average being 7 feet, below mean low tide. The revetment and groins protecting the head of Mustang Island have suffered from caving of the bank supporting the work; and the effect of storm-waves, time, and other causes has resulted in their deterioration to such an extent as to require somewhat extensive repairs. The salt cedars planted in February are growing finely, and already are collecting sand. Some shoaling has taken place in the bar channel, the soundings made showing that from a point opposite the Mary, to a point near the outer end of the jetty, but 10 feet of water is available at mean low tide. It is believed, however, that the shoaling is but temporary, having been caused by the very prevalent north and northeast winds of the spring, which invariably have a tendency to shoal this bar.

PROBABLE OPERATIONS OF THE YEAR ENDING JUNE 30, 1887.

Available funds will be applied to the work of rendering secure the head of the island, and continuing work to obtain the necessary concentration desired to scour the bar down to 12 feet, required for navigation.

The work will be in accordance with approved project, and will be in continuance of that heretofore constructed.

During the fiscal year ending June 30, 1888, there could be profitably expended $600,000, in constructing works at the pass and improving the interior channels.

The work is located in the collection district of Corpus Christi, and the nearest light-house is at Aransas Pass.

Money statement.

July 1, 1885, amount available	$6,913 11
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	3,913 21
July 1, 1886, amount available	2,999 90
Amount appropriated by act approved August 5, 1886	101,250 00
Amount available for fiscal year ending June 30, 1887	104,249 90
Amount (estimated) required for completion of existing project	719,472 75
Amount that can be profitably expended in fiscal year ending June 30, 1888	600,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

ROCKPORT, TEX., *July* 14, 1886.

SIR: Your favor of 5th instant, received, and in response we beg to hand you statement of the business of this port, Fulton and Saint Mary's, for the fiscal year ending June, 1886:

Outward shipments:

Cattle	head	4,565
Merchandise	barrels	4,120
Fish and turtle	pounds	306,000

Inward shipments:

Merchandise	barrels..
Lumber	feet..
Shingles	feet..

Very respectfully,

COLEMAN FULTON PASTURE COMPAN
SAM. J. SEYMORE,
Secretary and Trea

Col. S. M. MANSFIELD.

LETTER OF COLLECTOR OF CUSTOMS AT CORPUS CHRISTI, TEXAS.

CUSTOM-HOUSE, CORPUS CHRISTI, TEX.
Collector's Office, July 20,

DEAR SIR: In accordance with your request of the 5th instant, I have the h
inclose a report of transactions for the fiscal year ending June 30, 1886.

In the matter of entrances and clearances, domestic ports, the report is no c
to judge of the actual commerce of the port by, as only those vessels having
goods report at the custom-house.

Any further information in my power will be cheerfully given.

Very respectfully,

CHARLES F. BAILEY
Coll

Col. S. M. MANSFIELD.

ENTRANCES AND CLEARANCES.

Vessels entered from foreign ports	
Vessels cleared for foreign ports	
Vessels entered from domestic ports	
Vessels cleared for domestic ports	
Value of exports to foreign countries	$134,
Value of imports from foreign countries	1,476,

S 8.

IMPROVEMENT OF HARBOR AT BRAZOS SANTIAGO, TEXAS.

Estimate for jetties and interior dam, 1881	$678
Appropriated, 1885-'86	*185
Balance of estimate	493

ORIGINAL CONDITION OF THE LOCALITY.

The pass which forms the connection between the Laguna Mad
the Gulf of Mexico separates Brazos Island from Padre Island, a
harbor within was obstructed directly across the mouth of the p
a bar in the usual curved form, situated so as to be entirely expo
heavy storms, and, being of a quick-sand formation, easily acted
by tidal currents. The best water (in an ever-shifting channel) ac
was about 7 feet. In the harbor the greatest depth was 27 feet.

PROJECT FOR IMPROVEMENT.

To extend two parallel jetties entirely across the bar to the 1
curve, the width between the jetties to be about the same as th

---

*In addition there was appropriated, in 1878, $6,000, which was applied to re
a wreck.

rowest part of the pass, viz, 1,500 feet; the south jetty (Brazos Island jetty) to be 3,630 feet long, and the north jetty (Padre Island jetty) to be 2,940 feet; the direction of the jetties to be in prolongation of the pass; the estimated cost of the south jetty about $190,000; estimated cost of the north jetty about $130,000. In addition, to construct a dam from Point Isabel to Brazos Island, to increase the depth of water on the bar and in the channel to Point Isabel, by preventing the flow toward Boca Chico; the estimated cost about $328,000.

Approval was given to so much of the project as covered the construction of the south jetty, leaving the question of the north jetty and of the inner dam to the future.

OPERATIONS FROM 1882 TO JUNE 30, 1885.

A south jetty, with a total approximate length of 3,500 feet, was constructed, in the building of which there were used 54,096.74 cubic yards of brush-work and brick ballast.

The amount expended in this work, including superintendence and contingencies, was $184,148.72, and resulted in effecting some improvement in the bar channel, not strictly permanent because of the incomplete condition of the jetty.

No funds were available for operations during the fiscal year 1885-'86, and no work was done.

PROBABLE OPERATIONS OF THE YEAR ENDING JUNE 30, 1887.

For certain reasons the subject of this improvement was referred by letter of December 8, 1885, Office of the Chief of Engineers, to the Board of Engineers, with a view to obtaining the opinion of the Board as to the probable cause of an alleged shoaling on the bar and for suggestion of a remedy. There being no funds sufficient for the purpose of making an examination and survey required by the Board, the Chief of Engineers, under date of February 4, 1886, directed that as soon as funds became available for the purpose a project, with estimate of the cost of the survey, be submitted, so that the necessary steps for its commencement be entered upon without delay.

It is estimated that $4,000 will be necessary to make the examination and survey required. The work of improvement will necessarily await the action of the Board; consequently the operations of the year cannot here be outlined.

During the fiscal year ending June 30, 1888, there could be profitably expended $200,000 (the annual estimate) in continuing work of improvement.

It is located in the collection district of Brownsville, Tex., and the nearest light is Brazos Island light-beacon.

Money statement.

July 1, 1885, amount available	$851 28
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	515 00
July 1, 1886, amount available	336 28
Amount appropriated by act approved August 5, 1886	37,500 00
Amount available for fiscal year ending June 30, 1887	37,836 28
Amount (estimated) required for completion of existing project	455,584 50
Amount that can be profitably expended in fiscal year ending June 30, 1888	200,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

APPENDIX T.

IMPROVEMENT OF RED RIVER AND OF CERTAIN RIVERS IN THE STATES OF LOUISIANA, MISSISSIPPI, AND TENNESSEE TRIBUTARY TO THE MISSISSIPPI—WATER-GAUGES ON THE MISSISSIPPI AND ITS PRINCIPAL TRIBUTARIES.

REPORT OF CAPTAIN ERIC BERGLAND, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Red River, Louisiana and Arkansas.
2. Survey of Bayou Pierre, Louisiana.
3. Cypress Bayou, Texas and Louisiana.
4. Cane River, Louisiana.
5. Loggy Bayou, Lake Bisteneau and the Dorcheat, Louisiana.
6. Ouachita and Black rivers, Arkansas and Louisiana.
7. Bayou Bartholomew, Louisiana and Arkansas.
8. Bayou Bœuf, Louisiana.
9. Tensas River and Bayou Macon, Louisiana.
10. Bayou D'Arbonne, Louisiana.
11. Yazoo River, Mississippi.
12. Big Sunflower River, Mississippi.
13. Tchula Lake, Mississippi.
14. Tallahatchee River, Mississippi.
15. Yallabusha River, Mississippi.
16. Steele's Bayou, Mississippi.
17. Big Black River, Mississippi.
18. Big Hatchee River, Tennessee.
19. South Forked Deer River, Tennessee.
20. Water-gauges on the Mississippi River and its principal tributaries.

WILLETS POINT, NEW YORK HARBOR,
July 27, 1886.

SIR: I have the honor to submit herewith annual reports upon the works of river and harbor improvement under my charge during the fiscal year ending June 30, 1886.

Very respectfully, your obedient servant,

ERIC BERGLAND,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

T 1.

IMPROVEMENT OF RED RIVER, LOUISIANA AND ARKANSAS.

Red River has its headwaters in Northern Texas and flows in an easterly direction, forming the boundary between Indian Territory and Texas. At Fulton, Ark., it changes its course to a general southeasterly direction, and enters the Mississippi at Red River Landing, La.

Appropriations for the improvement of this river were made at vals between 1828 and 1841. Between 1841 and 1852 no appropr was made, and a longer interval of twenty years elapsed betwee and 1872, during which time the results of work previously don lost.

The improvement from 1872 to 1881 was carried on under vario propriations for removing raft in Red River and closing Tone's I removing obstructions from Red River, and improving Uppe River from Fulton, Ark., to head of raft. The river and harbor August 2, 1882, combined all work on this stream in the general improving Red River, which includes the whole river from F Ark., to the mouth of Atchafalaya River, a distance of about 525

The present improvement dates from 1872. At that time navi above Shreveport, La., was almost impossible on account of the raft. A survey of this obstruction was made in 1871–'72, and esti submitted for its removal and the subsequent improvement of the The work of removing this great obstruction was begun Decem 1872, and the opening of the channel through the raft was com November 27, 1873. The work in the raft region since that tin consisted in removing portions of the old raft, leaning timber, and from the banks, and breaking jams to prevent blockading of the and reformation of the raft. This work has been done principa means of crane, derrick, and snag-boats. In 1879 an examinatio made for the purpose of ascertaining the changes in the river sin raft was opened, and it was found that the high-water line had b duced to a level generally within the banks, a greater depth of everywhere secured, and an enlarged section of channel-way g and that very little water was diverted from the river proper stages.

UPPER RIVER FROM FULTON, ARKANSAS, TO SHREVEPORT, I IANA.

By river and harbor acts of 1879 and 1880 appropriations were for improving the river from Fulton, Ark., to head of raft. An e nation of this part of the river was made and report thereon subi in 1879. At the same time a report was submitted on an exami of the stream above Fulton to the Missouri, Kansas and Texas Ra Bridge.

Previous to this, in 1875, some leaning timber was cut betwe head of raft and a point 24 miles below Fulton. Work was be September, 1879, at Fulton and continued down-stream until Dece This work was resumed in September, 1880, and continued until water in December. By the work of these two seasons the rive placed in good navigable condition, when there was sufficient wa boats to run, but as many new obstructions were added by the fl 1881 the balance of appropriation for this work, with a portion o for improving Red River, was used in their removal.

During the season of 1882–'83 and 1883–'84 the two snag-boats, ell and Florence, principally the latter, were employed in removi structions from the bed and banks of the river.

During the fiscal year ending June 30, 1885, shore parties re numerous obstructions from the banks, and the two snag-boats re formidable raft formations in the old raft region, caused by the which occurred early in May.

A dam was built closing the outlet known as the Sale and M Canal. This was completed the latter part of November, 1884. I it had time to consolidate the December flood came and it was completely destroyed.

No work has been done during the present fiscal year, owing to the small amount of funds available for the improvement of Red River. A portion of the small balance available has been held in reserve to provide for emergencies such as the absolute closure of the river by drift brought down by floods. These usually occur in April or May, but this year has been an exception to the general rule in that the spring floods have not occurred.

The work accomplished up to this time has greatly benefited navigation at all stages. The great raft has been removed and its re-formation prevented, and the river has been kept open to Fulton, to which point boats ascend when there is water enough. During the present fiscal year the channel has become more or less obstructed by snags, bank-slides, and leaning trees, which make navigation tedious and hazardous.

LOWER RIVER, FROM SHREVEPORT, LOUISIANA, TO THE MOUTH.

An examination of Tone's Bayou was made in 1871-'72. The river and harbor act of 1872 appropriated $20,000 for the improvement, the object being to improve the navigation of Red River below Shreveport, it having been seriously affected by the gradual enlargement of Tone's Bayou, the water passing into it depleting the main channel of the river below, causing it to shoal and become narrow without giving another naviagble channel. The project for this improvement, submitted July 16, 1872, recommended closing the bayou with a dam, having its top 10 feet below high-water mark, in order to throw an increased volume into the main river. As the bed of the river enlarged it was proposed to increase the height of the dam by annual appropriations until the bayou should be finally closed. This dam was completed in January, 1873, and destroyed by high water the following March.

In May, 1873, it being found desirable to run drift from the Red River raft out of the navigable channel below Shreveport, the plan of running it into the bayou and closing the latter with a raft was adopted. A boom was therefore constructed and a large raft formed at the site of the dam, but this was also entirely swept away July 8, 1873, going down Tone's Bayou and thence into Bayou Pierre. A second raft was formed later in the season, but the water cut under it and consequently no valuable results were obtained. This also went subsequently with the current into Bayou Pierre.

A plan was submitted in the Annual Report of 1874 to entirely close the bayou with a dam of same height as levees along the river, and the citizens of Shreveport and others interested also urged the total closure of the bayou at that time. The dam was begun in October, 1876, and continued with frequent interruptions from high water until September, 1879, when it was discontinued for lack of funds. At this time the dam had reached a height of 24 feet, or 12 feet below high-water mark, and the top was covered with a heavy layer of stone to weight the mattresses down and prevent drift from damaging the dam. It was found necessary to keep a watchman on the work continuously to see that the dam was not cut, and to prevent the people from carrying away the stone, which is a scarce article in that locality. This dam, although really a low-water dam, was of great benefit to navigation below Shreveport. The water of 1879 reached a point 3½ feet below the low water of 1878, the lowest previously known; but, notwithstanding this, steamboats made regular trips from Shreveport to Grand Ecore, a thing never attempted before the partial closing of the bayou.

It soon became evident that a low-water dam could not be maintained, hence, in 1880, it was proposed to put in an earthen dam up to high-water mark, just above the former, and connect its ends with the levees on Red River, and also dam the lower branch of Old River. A contract for this work was entered into in August, 1881, which was to be finished during the low-water season of 1881. This the contractors failed to do, and on the night of December 1, 1881, the Confederate dam, built in 1864 across Lower Old River, below the projected dam, was destroyed, carrying with it the incompleted dam above. According to affidavits of the agent of the contractors, and several of his men, on February 14, 1882, a body of masked men approached the main dam, took charge of the guards, and cut a ditch across the dam, the effect of which caused its destruction. The work being incomplete, had not been accepted by the United States when the dams were destroyed, and consequently no payment was made to the contractors.

In September, 1874, a survey was made of the falls at Alexandria; another was made in 1878, and a report thereon submitted December 20, 1879, with a project for excavating a channel 75 feet wide, with a permanent depth of 4½ feet below the low water of 1874, through the upper falls, and for building a dam at the lower falls with the rock removed from the channel above. The work of excavation was let by contract October 14, 1882, at $3.45 per cubic yard. Owing to lack of experience and suitable plant this work progressed slowly, and several extensions of time were requested and granted.

During the present fiscal year work was resumed August 20, 1885, and continued until, by direction of the Chief of Engineers, the contractor was notified that the contract was closed, November 25, 1885. At that date he had excavated 7,630.5 cubic yards of rock, which had been deposited on the dam at the lower falls.

The channel cut through the upper falls is practically completed, although the last survey shows that at a few points (principally along the sides of the cut) the requisite grade had not been attained. Since work was discontinued many boats have passed through the cut at low stages without experiencing any difficulty or meeting any obstructions. The channel has been plainly indicated by means of range marks on shore, so that during daylight no difficulty in keeping in the excavated channel is experienced.

The rock and débris obtained from the upper falls have been deposited in the dam at the lower falls. This has sufficed to close the channel along the west shore, and has changed the direction of the current from the west to the east shore. The result has been almost total cessation of erosion of the west bank and the removal of the extensive sand-bar which extended along the east bank. The rock excavated in the channel at the upper falls, from which the dam has been built, is soft and friable, much of which crumbles into small fragments when exposed to the air. Hence it was feared that during high water a large portion would be washed away. Such has not been the case; the clay binds together the rock fragments, forming a stable concrete which resists the action of the water. In order to secure the diversion of the current from the west shore during high water it may become necessary to increase the height of the dam several feet. Rock for this purpose can be obtained from a quarry near the east bank, about one mile above the dam.

The closing of the west chute has caused a very rapid current through the middle channel of the Bailey Dam at low stages. This necessitates the use of lines to enable boats to stem the current, but the dam also benefits the passage over the upper falls by increasing the depth above it. It may be necessary to widen the channel through the Bailey Dam so as to decrease the velocity of the current without increasing the slope too much above the dam.

The project for the protection of the harbor at Alexandria, as described in my last annual report, has been completed as far as the funds available would permit. Work was resumed August 19, 1885, and discontinued December 5, 1885. Amount expended, $14,864.41. The training wall was made somewhat shorter than projected, because on resumption of work it was found that the site had been scoured out to a greater depth than when the estimates were submitted. Hence only 14 cribs of the training wall could be built, instead of 18 cribs as given in the original project. This work, in connection with the dam at the lower falls, has been of some benefit to the river-bank at Alexandria. During the fiscal year but little caving of the bank has taken place, and that little has been due to a stratum of quicksand, which causes a sloughing of the bank when the river falls. This sloughing would probably be diminished or arrested if a deposition of sand and sediment occurred along this shore of sufficient depth to cover this stratum of quicksand. To cause such deposition it may be necessary to increase the height of the wing-dam, already built, and to construct one or two additional dams.

The river and harbor acts of 1878 to 1881, inclusive, made appropriations for removing snags and other obstructions from Red River, Louisiana. This work extended from the mouth to Shreveport, and was begun August, 1878, by the snag-boat Wagner, and continued until October, 1881. A shore-party was also employed in 1879 to remove bank obstructions. The snag-boat C. W. Howell was built by contract and received in November, 1881.

During the seasons of 1882–'83 and 1883–'84 the Howell and Florence (principally the former) were employed in removing obstructions below Shreveport. During the latter part of 1882 the United States snag-boat John R. Meigs was temporarily transferred to this river from the Yazoo, to replace the Howell while the latter was undergoing repairs.

During the last fiscal year (1884–'85) the snag-boat Howell and shore-parties removed numerous obstructions to navigation. The snag-boat Florence was sunk at O. K. Bar, raised and towed to Saint Louis, where she was repaired, returning to Shreveport April 15, 1885.

No work has been done for the general improvement of the river during the present fiscal year, as the funds available were insufficient. The property pertaining to this improvement has been stored at Alexandria and Shreveport, and has been well cared for.

The work done heretofore has been of great benefit to navigation; that done by the Howell in 1885 having been eminently satisfactory to those engaged in the navigation of the river. During the present fiscal year many obstructions have formed, which require speedy removal in order to make navigation easy and secure. This is especially the case below Tone's Bayou in the "narrow river," where every effort should be made to assist nature in widening and deepening the water-way.

During the recent low water a bar has formed in the draw of the railroad bridge at Shreveport, preventing boats from passing up or down. A report on this obstruction was submitted to the Department, June 18, 1886.

With the amount asked for the fiscal year ending June 30, 1
proposed to continue the improvement of the river by means
boats and shore-parties below and above Shreveport, to cor
improvement at the falls of Alexandria, and extend the wor
protection of the harbor at Alexandria if authority be grante
extension. It is considered of great importance that the surv
River from Fulton to its mouth be authorized.

The estimate for this survey is $45,000. Without such sur
intelligent project for the permanent improvement of this impor
can be submitted.

Appropriations aggregating $535,765.50 were made at int
tween 1828 and 1852. The present improvement dates from
the following amounts have been appropriated:

By act approved June 10, 1872, for improving Tone's Bayou ....
By act approved June 10, 1872, for removing raft...... ....
By act approved March 3, 1873, for removing raft.......................
By act approved June 23, 1874, for removing raft....................... ....
By act approved March 3, 1875, for removing raft ....
By act approved August 14, 1876, for removing raft and closing Tone's Bayou ....
Allotment August 27, 1877, for closing Tone's Bayou ....
By act approved February 7, 1878, for removing raft, &c ....
By act approved June 18, 1878, for removing raft and closing Tone's Bayou.
By act approved June 18, 1878, for removing snags and other obstructions.
By act approved March 3, 1879, for removing raft and closing Tone's Bayou.
By act approved March 3, 1879, for removing obstructions.................
By act approved March 3, 1879, for improving upper river from Fulton, Ark., to head of raft..
By act approved June 14, 1880, for improving upper river from Fulton, Ark., to head of raft..
By act approved June 14, 1880, for removing raft and closing Tone's Bayou ....
By act approved June 14, 1880, for removing obstructions ....
By act approved March 3, 1881, for removing obstructions.................
By act approved March 3, 1881, for removing raft and closing Tone's Bayou ....
By act passed August 2, 1882, for improving Red River.....................
By act approved July 5, 1884, for improving Red River.....................

Amount appropriated since 1872...........................
Amount expended to June 30, 1886 ....

Money statement.

July 1, 1885, amount available...
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885..... ....

July 1, 1886, amount available..................................
Amount appropriated by act approved August 5, 1886 ....

Amount available for fiscal year ending June 30, 1887.................

Amount that can be profitably expended in fiscal year ending June 30, 1888
And, in addition, for survey of Red River, Louisiana and Arkansas....
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

During the fiscal year Upper Red River (above Shreveport, La.) was n
four steamboats, drawing from 2½ to 5½ feet of water, and with carrying
ranging from 100 to 400 tons each. This part of the river was navigable t
Tex., for two months; to Fulton, Ark., for four months, and to Garland

the entire year. The boats made a total of 73 trips, or an average of 18 for each boat, and carried the following freights:

Cotton	**bales**	**11,800**
Cotton-seed	**sacks**	**48,675**
Shingles	**bundles**	**2,400**
Miscellaneous freights	**tons**	**300**

Lower Red River (below Shreveport, La.) was navigated by 9 steamboats, drawing from 5 to 9 feet of water, and with carrying capacities ranging from 200 to 800 tons each. Navigation was good between Shreveport and the mouth of the river, except during September, October, and November, 1885, when Grand Ecore was the head of navigation. The boats made a total of 108 trips, or an average of 12 for each boat, and the following freights were carried:

Cotton	**bales**	**71,686**
Cotton-seed	**tons**	**3,350**
Cotton-seed oil	**barrels**	**3,975**
Hides	**pounds**	**125,000**
Wool	**do**	**100,000**
Staves	**number**	**120,000**
Cattle	**head**	**1,000**
Wood	**cords**	**500**
Oil-cake	**tons**	**550**
Oil-cake meal	**do**	**1,000**

Return freights, 21,500 tons general merchandise and plantation supplies; estimated value, $2,500,000.

This has been a season of unusually restricted navigation; and but for this reason it is thought the amount of commerce would have been much greater.

Shreveport, La., having a population of about 12,000 inhabitants, is the main distributing point for Red River.

The following are the commercial statistics of Shreveport for the past year:

Cotton received at Shreveport	**bales**	**82,500**
Cotton-seed received at Shreveport	**tons**	**5,512**
Refined oil shipped from Shreveport	**barrels**	**3,285**
Soap stock shipped from Shreveport	**tons**	**849**
Cotton-lint shipped from Shreveport	**do**	**110**
Cotton-seed meal shipped from Shreveport	**sacks**	**25,354**
Oil-cake shipped from Shreveport	**do**	**1,525**
Ashes shipped from Shreveport	**do**	**29**

Freight shipped to Shreveport, no record.
Freight shipped from Shreveport, no record.

In addition, large quantities of miscellaneous freight, hides, tallow, &c.

T 2.

SURVEY OF BAYOU PIERRE, LOUISIANA.

The Bayou Pierre region is that part of the Red River Valley lying between the river proper and the pine hills on the west, and reaching from a point 2 miles below Shreveport to Grand Ecore, La. It has a southward extent of 60 and a maximum width of 9 miles.

Red River through this region seems to have very nearly its original course, its present banks being the highest part of the bottom. Its principal changes have probably been several local cut-offs within the first 20 miles and near the end of the reach. As far as Tone's Bayou, 18.7 miles by river below Shreveport, it has an average, slightly diminishing, width of about 400 feet and a clear low-water depth of at least 12 feet, except at one point. Below, however, its width suddenly lessens to 150 feet and its depth to 6 feet, the reduction being due to a serious depletion of the stream through Tone's Bayou. This lower river is very tortuous in its course, has a quite uniform channel, and is seri-ably of late. For the next 12 or 15 miles below Grand Bayou, Bayou Pierre has numerous rapids, over bars of hard, insoluble clay; those farthest up-stream being somewhat rocky. Its average width is about 140 feet and its low-water depth between rapids about 15 feet. The snags in this part, according to the report of Mr. Wilson, in 1879, average about 54 to the mile. Below this, for 6 miles through Bayou Winsey to Red River, there is a deep and unobstructed channel.

Mr. Wilson reported that Bayou Pierre for 2 miles below Bayou Winsey was closed to a height of 13¼ feet above low water; that thence there was for 3 miles a good channel; that thence for 16 miles to Spanish Lake the bayou was made almost impassable by snags and cypress knees; and that from Spanish Lake to Red River there was an open channel.

The streams described below carry water only at high stages.

Sand Beach Bayou virtually leaves Red River at Shreve's Cut-off, 6 miles below Shreveport, and enters Bayou Pierre 3 miles above Tone's Bayou. Bayou Chicot leaves Bayou Pierre on the right, 1½ miles below Tone's Bayou, and returns 3 miles lower down, with a small issue between, into Wallace Lake. Pascagoula Bayou traverses the bottom from Red River, 12½ miles below Scopini's Cut-off, to Bayou Pierre, 3 miles above Red Bluff. It is completely closed by two levees crossing. Prairie River, crossing Pascagoula Bayou between these levees, and draining the low lands near Bayou Pierre above, runs between Red River and Lake Cunnisnia, with an issue into Bayou Pierre at Le Coup, and crossing Bayou La Chute near Bayou Pierre, passes parallel with the latter below into Lake Pierre. Bayou La Chute crosses from Red River to Bayou Pierre near the foot of Lake Cunnisnia. At high water it drains both ways, but principally into Bayou Pierre. Cross Bayou and Murrell's Cut are outlets from Lake Pierre to Red River.

The land between Bayou Pierre and Red River is regarded as very fertile. Only the high ground just along the river, however, is cultivated. Probably less than one-fourth of it is available for tillage, the rest being subject to overflow and heavily timbered.

The proper improvement of Red River from Tone's Bayou to Grand Ecore has long been a mooted question. The Government has hitherto undertaken to maintain the river route proper by damming up Tone's Bayou. This has been deemed most advisable by the State engineers of Louisiana, and by the United States Engineer officers in charge of the work. The execution of this project has met with considerable opposition from the planters and others in the vicinity. Those along the front, or on Red River proper, seem to think that the damming of Tone's Bayou would cause the overflow of their lands, while those living on the back channel, or Bayou Peirre, desire to have the latter cleaned out and otherwise improved, and made the main steamboat channel from Tone's Bayou to Bayou Winsey or Grand Ecore. This opposition appears to have become more apparent in late years; for in 1874 Capt William Robinson was deputed by the Shreveport Board of Trade to represent to the Secretary of War the importance of closing Tone's Bayou, and in 1879 citizens of New Orleans and others interested in the navigation of Red River subscribed $3,000 to help repair the dam across the bayou.

The relative advantage of the two routes was discussed at length by Major Howell in Annual Report of Chief of Engineers for 1873, page 628, and by Major Benyaurd in Annual Report for 1882, page 1539.

In the latter part of 1878 an examination was made of Tone's Bayou, Bayou Pierre, and connecting lakes and bayous to Bayou Winsey, in order to ascertain the cost of opening up this route to navigation; this was estimated at $174,404, including the cost of removing the raft in Bayou Pierre, which was estimated at $75,000.

In the spring of 1883 another examination of this region was made, and the estimate for making a navigable channel from the mouth of Bayou Winsey to the entrance of Tone's Bayou, given at $250,125, and for the removal of the raft alone $100,000. The report on this examination recommended an accurate survey of the Bayou Pierre region, at an estimated cost of $8,646. This was based on a detailed estimate submitted to the Department December 29, 1882, in which it was assumed that the field work could be completed in three months.

In order to obtain all the data necessary for a complete discussion of the questions involved, it was considered necessary to include in the survey all the water-ways or bayous lying between Bayou Pierre proper and Red River, from the head of Bayou Pierre to Bayou Winsey, and also Red River between these points. The actual field work of the survey was commenced October 22, 1884, and discontinued January 20, 1885, on account of high water. Mr. Hart Vance, assistant engineer, who has had long experience on the Missouri River and other Government surveys, was placed in charge of the work. During the fiscal year ending June 30, 1885, the following work in the field and office was accomplished:

The survey of Red River from Shreveport, 18¾ miles above Tone's Bayou, to Caspiana Landing, 25.19 miles below, affording an accurate representation of the channel contours and of all adjacent topography; surveys of Bayou Pierre and all bayous between that and Red River from Shreveport to Tone's Bayou; surveys of Tone's Bayou, Bayou Pierre through the raft region, the numerous side issues and small channels into which the water is driven by the raft, and the western part of Lake Cunnisnia to a point about 2 miles above Le Coup; surveys of Pascagoula Bayou and of Prairie River as far as Caspiana Landing; a detached survey of Bayou La Chute and the various channels between Lakes Cunnisnia and Pierre; an examination of Le Coup Bar; divers transit and chain lines for checks, location of levels, &c., along Red River, and between Red River and Bayou Pierre; and observations for discharge in Red River above Tone's Bayou and in Tone's Bayou. The survey included a system of perfectly-checked levels along Red River, Tone's Bayou, and Bayou Pierre, and over three lines between Red River and Bayou Pierre, with frequent observations of water-level and high-water elevations. Gauges were established and read at Shreveport, Cotton Point, Bayou Winsey, and the site of the camp. The survey was mapped on a scale of $\frac{1}{8000}$, making four sheets 10 feet by 42 inches; cross-sections of all of Red River surveyed and of Tone's Bayou and Bayou Pierre to the head of the raft were developed, and comparative profiles of high water, low water, bank and channel-bottom elevations were in process of construction. About one-fourth of the ink-work on these sheets was done.

During the present fiscal year the profiles of high and low water and channel sections were completed and ink-work upon the large maps was [illegible] from time to time. Between August 22 and September 2, [illegible] Engineer H. Vance went over the track of the survey [illegible] Regiey's Crevasse, a threatened cut-off from old Lattier Bend [illegible] Bayou; supplementing some topographical work which [illegible]; taking high-water and low stage elevations at Red [illegible] Point, and connecting with permanent marks the ter[illegible] survey submerged in Lake Cunnisnia in December, [illegible]

The completion of the survey as projected will involve surveys of Red River, 48 miles; Bayou Pierre, 16 miles; Prairie River, 10 miles; Grand Bayou, 2.5 miles; Cross Bayou, 6 miles; Bayou Winsey, 2.5 miles; possibly several other collateral courses, Lake Pierre, and, practically, half of Lake Cunnisnia.

Several unforeseen circumstances combined to make the cost of the survey exceed the origanal estimate, among which may be mentioned the following: Owing to the lateness of the season, in 1884, when I assumed charge of the work, the organization of the party was so hurried that it was impracticable to obtain in all cases assistants of experience or assured compentency, and consequently some of the early work was valueless, and had to be repeated after reorganizing the party. Failures in the timely delivery of necessary outfit retarded the commencement of the work, after nearly all the expenses of a full party had been assumed. Again, nearly three-fourths of the last month in the field was lost on account of rains, storms, and floods; not more than one full week's work having been done from December 23, 1884, to January 21, 1885.

The interruption of the field work, its suspension owing to high water, and its resumption after a lapse of over 18 months, will necessarily occasion a greater expense than if it had been completed without interruption.

As the survey is incomplete, no estimate can now be submitted of the cost of opening the Bayou Pierre route to navigation. It is, however, of great importance that the survey be completed as contemplated, in order that the question of cost and advisability of opening the Bayou Pierre route may be definitely settled. The cost of completing the surveys to Bayou Winsey is estimated at $5,000.

Money statement.

July 1, 1885, amount available	$663 85
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	525 80
July 1, 1886, amount available	138 05
Amount (estimated) required for completion of existing project	5,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	5,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

T 3.

IMPROVEMENT OF CYPRESS BAYOU; TEXAS AND LOUISIANA.

The improvement of Cypress Bayou has included the whole navigable route from Shreveport, La., to Jefferson, Tex., *via* Sodo and Fairy lakes and Cypress Bayou. An examination was made by the United States in 1872, and the work of improvement begun the same year and completed in 1880; a well-defined channel marked with sign-boards, from Shreveport to Jefferson, a distance of 65 miles, being the result of the work.

In July, 1884, a steamer was chartered and employed during the month in removing obstructions, such as snags and leaning trees.

T 4.

IMPROVEMENT OF CANE RIVER, LOUISIANA.

Cane River is an arm of Red River, about 70 miles in length from its upper end, 2 miles below Grand Ecore, where it leaves Red River, to Colfax, La., where it again joins that stream. It was formerly part of Red River, but in 1849 a cut-off turned the river into its present bed, and Cane River has gradually filled up, until at present it is nearly dry for six months in the year. An examination was made by the United States in December, 1882, and the obstructions to high-water navigation were found to be snags, logs, stumps, caved in and leaning trees, and some rock. No estimate of cost of improvement was submitted by the United States engineer officer in charge, but his assistant estimated the cost of removing the obstructions at $7,665.

The only appropriation for this improvement ($2,500) was made by river and harbor act approved July 5, 1884, and the obstructions were removed during the season of 1884, as far as practicable, with that amount. This work resulted in freeing the channel, to a great extent, of obstructions, increased the depth of water during the navigable season, and enabled steamboats to make quicker trips.

No work was done during the past year for want of funds.

Some obstructions yet remain, the removal of which would lessen the danger of navigation, and some new obstructions are formed yearly, though not to such an extent as on other streams in this locality, as the banks are high, and for about 50 miles are covered with Bermuda grass, and therefore not subject to abrasion; the remaining 20 miles is covered with a heavy growth of timber, and the banks are continually caving and sliding.

This stream being an arm or high-water channel of Red River, it is recommended that appropriations for future improvement be included in those for the main stream, in which case necessary work can be done when and where the interests of navigation require it. No specific amount is therefore asked for the separate improvement of this stream.

Money statement.

July 1, 1885, amount available	$149 69
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	75 00
July 1, 1886, amount available	74 69

COMMERCIAL STATISTICS.

During the fiscal year two small steamboats, drawing 3½ feet of water and of 100 tons burden each, navigated this stream, making 22 trips, and carrying the following freights:

Cotton	bales	1,000
Cotton-seed	sacks	10,000
Hides	pounds	10,000

The river was navigable during March, April, and May. When the water in Red River is at high stages boats pass entirely through Cane River, but owing to the unusually low water in the main stream during the past year, navigation has been limited both in time and extent, and boats could only ascend Cane River as high as Hertzog's plantation.

T 5.

IMPROVEMENT OF LOGGY BAYOU, LAKE BISTENAU, AND THE DORCHEAT BAYOU, LOUISIANA.

Dorcheat Bayou rises in Hempstead County, Arkansas, and flows in a southerly direction into Lake Bistenau, which empties through Loggy Bayou into Red River, about 110 miles below Shreveport, La.

An examination of the system was made by the United States in December, 1882, when it was found to be obstructed with logs, stumps, leaning trees, brush, &c., and that it was navigable at high water as far up as Murrell's Point, on Dorcheat Bayou, near Minden, La. (about 30 miles above the mouth of Loggy Bayou), for about five months of the year. No estimate of cost of improvement was submitted by the United States Engineer officer in charge, but his assistant, who made the examination, estimated the cost of removing obstructions, building dams, and dredging where necessary, in order to increase the period of navigation two months, at $19,338.

The only appropriation for this improvement ($5,000) was made by river and harbor act approved July 5, 1884, and the most serious obstructions to high-water navigation were removed during the season of 1884. This work extended over the navigable portion of the lake and bayous, *i. e.*, from Murrell's Point, on the Dorcheat, to the mouth of Loggy Bayou, and greatly benefited navigation, increasing the depth of water in many places, and enabling boats to run to the head of navigation during six months of that fiscal year.

No work was done during the present fiscal year, as the unexpended balance was insufficient to resume operations.

The improvement, like that of all streams in this part of the country, is not permanent, and even if the streams were entirely cleared of obstructions during one season, new ones, caused by sliding and caving banks, would constantly be added, and require removal from time to time. To lengthen the navigable season, dredging of bars and narrow places would be necessary. It is doubtful whether the demands of commerce would justify the great expenditure necessary for such improvement. Minden, which is the principal shipping point, is now connected by rail with the Vicksburg, Shreveport, and Pacific Railroad, consequently the importance of the water outlet has greatly diminished, although it is still a convenient evenue for the limited commerce of the country on the east side of Lake Bistenau and Loggy Bayou.

Money statement.

July 1, 1885, amount available	$431 79
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	340 00
July 1, 1886, amount available	91 79

COMMERCIAL STATISTICS.

These streams are usually navigable during high water by boats from Red River. Owing to the unusually low stages during the past year and the decreased commerce on account of the railroad facilities no boats have run during the fiscal year.

T 6.

IMPROVEMENT OF OUACHITA AND BLACK RIVERS, ARKANSAS AND LOUISIANA.

The Ouachita River has its headwaters in Polk County, Arkansas, in the Ouachita Mountains, and, following an irregular course, flows in a general southeasterly direction through Arkansas and Louisiana until, being joined by the Tensas and Little Rivers, at Trinity, La., these form the Black River, which, flowing in a southerly direction, enters the Red River near its mouth. The entire length of the Ouachita is about 500 miles. Black River is 75 miles long.

An examination of Ouachita River from Rockport, Ark., to the Louisiana line was made in 1870, and that portion from Rockport to Arkadelphia, Ark. (45 miles), was found to be little more than a mountain torrent, and was not considered worthy of improvement. A survey of the Ouachita River from Trinity, La., to Camden, Ark., was made in 1871-'72, the report on which recommended the building of five locks, which were to give not less than 4 feet of water in the river at all times, the estimated cost being $1,163,083.75. A resurvey from Camden to Trinity (294 miles) was made in 1873-'74, to determine more definitely certain questionable points connected with the contemplated improvement by locks, and in view of the great cost of the work and its doubtful utility the project was abandoned. The lumber which had been purchased for foundations, at a cost of $20,708.52, was sold at public auction and the proceeds turned into the Treasury. An examination of the river from Arkadelphia to Camden, Ark., was made in December, 1882, and it was recommended that no work be performed between those places.

By river and harbor act of 1884 Black River was added under the same head of appropriation with the Ouachita, this river being the connecting link between Ouachita and Red River, and requiring the same character of improvement. The present project contemplates the removal of obstructions to navigation, consisting of wrecks, logs, snags, leaning timber, &c., and the improvement of shoal places from Camden, Ark., to the mouth of Black River. No estimate of the cost of this improvement can be submitted, as the obstructions are continually forming and require removal from time to time.

Work was begun in 1871, and has been carried on ever since when funds were available, consisting principally in the removal of logs, snags, leaning trees, and similar obstructions to navigation. In 1875 the snag-boat O. G. Wagner was purchased and fitted up, and has operated successfully in the river since that time.

The work heretofore done has greatly benefited navigation by the removal of obstructions, and some of the shoal places have been increased in depth from 12 inches to over 3 feet at low water. Previous to any work of improvement large boats plied between New Orleans and Camden about half the year. These boats now run to Camden from seven to eight months in the year, and smaller boats run to Monroe, La., during the entire year.

During the season of 1884-'85 many formidable obstructions were removed. At that time no work in the river had been done since 1882, and in many places land-slides had occurred, some of them extending entirely across the river and greatly obstructing the channel. These and many other obstructions were removed, the greater portion of the work being between Monroe and the mouth of Black River. The appropria-

Return freights 2,200 tons, consisting of general merchandise and plantation supplies; estimated value, $1,805,000.

In addition to the above, the commerce of Bayous Bartholomew, Bœuf, and D'Arbonne, Tensas River, and Bayou Macon, all of which are tributaries, passes up and down the river, some of the boats from these tributaries extending their trips as far as New Orleans.

T 7.

IMPROVEMENT OF BAYOU BARTHOLOMEW, LOUISIANA AND ARKANSAS.

This stream is a tributary of Ouachita River. It rises in Southeastern Arkansas, within a few miles of Pine Bluff, on the Arkansas River, and following an exceedingly tortuous course, flows at first nearly parallel to the Arkansas River, at a distance varying from 15 to 30 miles; then parallel to the Mississippi at about the same average distance, and after entering Louisiana diverges to the southwest and flows into the Ouachita River opposite Ouachita City.

The States of Louisiana and Arkansas have at various times expended funds for surveys and improvements of the bayou. Examinations were made by the United States in 1872, 1879, and 1880. At Baxter, Ark., the Little Rock, Mississippi River and Texas Railroad Bridge crosses the bayou, forming a bar to all navigation above, except for stave boats, of which there are a great many in this part of the stream. An examination of the bayou from Baxter to the Lincoln County line, Arkansas, was made in December, 1884, the report on which (dated January 5, 1885) disapproves the improvement of this portion of the river at present.

The plan of improvement is based upon a report submitted by Major Benyaurd in 1880, estimating the cost of cutting overhanging timber and removing wrecks, snags, &c., obstructing navigation from Baxter, Ark., to the mouth, an estimated distance of 213 miles, at $26,862. The work heretofore done has extended over nearly the entire portion of the bayou included in this project, and has greatly lessened the dangers of navigation, but new obstructions are continually forming, which require removal from time to time in the interest of safe navigation.

No work was done during the fiscal year 1885–'86, no funds being available.

The appropriation asked for the fiscal year ending June 30, 1888, can be profitably expended in cutting leaning timber, removing snags, &c., as heretofore.

The former appropriations are as follows:

By act approved March 3, 1881	$8,000 00
By act passed August 2, 1882	5,000 00
By act approved July 5, 1884	5,000 00
Amount expended to June 30, 1886	17,978 82

Money statement.

July 1, 1885, amount available		$248 68
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$227 50	
July 1, 1886, outstanding liabilities		227 50
July 1, 1886, amount available		21 18
Amount appropriated by act approved August 5, 1886		5,000 00
Amount available for fiscal year ending June 30, 1887		5,021 18
Amount (estimated) required for completion of existing project		3,862 00
Amount that can be profitably expended in fiscal year ending June 30, 1888		4,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

During the fiscal year three steamboats drawing from 3 to 5 feet of wat
carrying capacities of 100, 300, and 400 tons, made twenty-seven trips in
The bayou was navigable for five months, and the following freights v
during these months:

Cotton	ba
Cotton-seed	sa
Staves	num
Hides	pou

Return freights, 1,750 tons, consisting of general merchandise and pla
plies, estimated value $500,000.

T 8.

IMPROVEMENT OF BAYOU BŒUF, LOUISIANA.

Bayou Bœuf rises in Southeastern Arkansas, flows in a so
rection, and enters the Ouachita River at Stafford's Point, abo
above Harrisonburg, La.

The plan of improvement is based upon an examination m
United States in 1880. The project contemplates the remova
logs, and leaning timber obstructing navigation between Walla
ing, La., and the mouth of the bayou, a distance of 280 miles
timated cost of $20,000. An examination of the three outlet
Bœuf, near Point Jefferson, La., was made in 1884, and th
recommended at an estimated cost of $8,500.

The work heretofore done was carried on during 1881, 1882,
The obstructions removed have greatly benefited navigation an
the dangers thereof, and boats are enabled to run during hig
Point Jefferson. The improvement is not permanent, as ne
tions form from time to time which will require removal in tl
of safe navigation. No work was done during the fiscal year
being available.

With the appropriation asked for the fiscal year ending Jun
it is proposed to apply $5,000 to the removal of obstruction
channel and banks as heretofore, and $8,500 to the closure
lets near Point Jefferson.

The former appropriations are:

By act approved March 3, 1881 ....
By act passed August 2, 1882 ....
By act approved July 5, 1884 ....
Amount expended to June 30, 1885 ....

Money statement.

July 1, 1885, amount available ....
July 1, 1886, amount expended during fiscal year, exclusive of liabilitie
outstanding July 1, 1886 ....

July 1, 1886, amount available ....
Amount appropriated by act approved August 5, 1886 ....

Amount available for fiscal year ending June 30, 1887 ....

Amount (estimated) required for completion of existing project ....
Amount that can be profitably expended in fiscal year ending June 30, 188
Submitted in compliance with requirements of section 2 of river and
harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

During the fiscal year 1 steamboat, drawing 5¼ feet, and with a carrying capacity of 300 tons, made 17 trips in the bayou, and 2 tug-boats with barges, drawing 3¼ feet, and with carrying capacities of 200 tons each, made 35 trips.

The following freights were carried:

Cotton	bales	9,370
Cotton-seed	sacks	18,590
Cattle	head	125
Staves	number	60,000
Wood	cords	427
Hides	pounds	8,000
Timber	logs	5,000

Return freights, 3,500 tons, consisting of general merchandise and plantation supplies, estimated value $250,000.

The bayou was navigable as high as Point Jefferson, La., for six months, and to Girard, La., for seven months of the past year.

T 9.

IMPROVEMENT OF TENSAS RIVER AND BAYOU MACON, LOUISIANA.

Tensas River has its source in Northeastern Louisiana, in Lake Providence, flows in a southerly direction, and uniting with the Ouachita and Little rivers, at Trinity, La., the three form Black River. By river and harbor act of July 5, 1884, Bayou Macon was united under the same head of appropriation with Tensas River. This bayou rises in Desha County, Southeastern Arkansas, flows in a southerly direction, entering Tensas River about 40 miles above its mouth.

Examinations of these streams were made in 1880, upon which the present plan of improvement is based. The project contemplates the removal of snags, logs, and leaning timber obstructing navigation in the Tensas, between Dallas and its mouth (about 180 miles), at an estimated cost of $23,000, and the removal of the same class of obstructions in Bayou Macon, from Floyd, the present head of navigation, to its mouth (about 130 miles), at an estimated cost of $17,000.

No work has been done in Bayou Macon, as the funds appropriated were not sufficient to extend operations into that stream.

Tensas River and Bayou Macon are navigable only during high stages of water in Ouachita River. The work heretofore done has benefited navigation in the former by the removal of obstructions from that portion of the stream in which it was carried on. This work, however, is not permanent, as new obstructions are added from time to time which require removal in the interest of safe navigation.

No work has been done since November, 1884, when the funds were exhausted.

With the appropriation asked for the fiscal year ending June 30, 1888, it is proposed to continue the removal of obstructions from the channel and banks as heretofore. If the whole amount estimated for be granted, work can be prosecuted in both streams.

The former appropriations are:

By act approved March 3, 1881	$3,000 00
By act approved July 5, 1884	4,000 00

Money statement.

July 1, 1885, amount available ....
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885 ....
Amount appropriated by act approved August 5, 1886 ....

Amount (estimated) required for completion of existing project ....
Amount that can be profitably expended in fiscal year ending June 30, 1888
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

During the fiscal year these streams were navigable from November t clusive. Tensas Bluff, about 95 miles above the mouth, was the head of navigation in Tensas River, from December to June, inclusive; Floyd, miles above the mouth of Bayou Macon, was the head of high-water na that stream, from January to June, inclusive.

Three steamboats, one of 300 and two of 400 tons, drawing from 5 to 6 fe loaded, made 21 trips in these streams, and two small steamboats of 50 to drawing from 2¼ to 3¼ feet, loaded, made 38 trips.

The following freights were carried:

Cotton	bales
Cotton-seed	sacks
Staves	number
Timber	logs

Return freights, 5,000 tons, consisting of general merchandise and plan plies; estimated value, $835,000.

T 10.

IMPROVEMENT OF BAYOU D'ARBONNE, LOUISIANA.

Bayou D'Arbonne is formed by the junction of the South, Mi North or Corney branches, near Farmerville, in Northern Loui flows in a southeasterly direction, and enters the Ouachita Riv miles above Monroe, La.

An examination and survey were made in 1883, and the pl provement is based upon the latter. The project contemplat moval of snags, logs, wrecks, leaning trees, &c., obstructing n between Stein's Bluff and the mouth, a distance of 42½ mil estimated cost of $15,000.

The only appropriation for the improvement was made by harbor act of July 5, 1884, $5,000, and was expended du season. This bayou, like the other tributaries of Ouachita navigable only during high stages of water in the main stre work done has resulted in the removal of obstructions from a half of that portion of the stream in which improvement is plated by the present project. The navigation of this pa stream has been improved and the dangers lessened by the r these obstructions. The work, however, is not permanent, a structions are added from time to time, which require remov interest of safe navigation.

No work has been done since December, 1884, when the fu exhausted.

With the amount asked for the fiscal year ending June 30, 1888, it is proposed to continue the removal of obstructions to navigation according to the project.

Money statement.

July 1, 1885, amount available	$130 59
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	104 66
July 1, 1886, amount available	25 93
Amount appropriated by act approved August 5, 1886	2,000 00
Amount available for fiscal year ending June 30, 1887	2,025 93
Amount (estimated) required for completion of existing project	8,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	5,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

During the fiscal year the bayou was navigable from January to May, inclusive, and boats ascended the stream to Stein's Bluff, 42½ miles above the mouth.

Three steamboats, of 100, 200, and 300 tons burden, respectively, and drawing from 3 to 4½ feet of water, made a total of 17 trips in the stream, and the following freights were carried:

Cotton	bales	8,000
Cotton-seed	sacks	10,000

Return freights, 600 tons, consisting of general merchandise, and plantation supplies; estimated value, $150,000.

T II.

IMPROVEMENT OF YAZOO RIVER, MISSISSIPPI.

Yazoo River is formed by the junction of Yallabusha and Tallahatchee rivers, in Le Flore County, Mississippi; it is about 264 miles in length, flows in a general southwesterly direction, through one of the richest sections of country in the South, and enters the Mississippi River 9 miles above Vicksburg.

An examination of the wrecks of gunboats, steamers, and other obstructions placed in the river during the late war was made by the United States in 1873, and a similar examination, which included the natural obstructions to navigation, was made in 1874. The project for the improvement contemplated the removal of wrecks, snags, logs, overhanging timber, &c., obstructing navigation throughout the entire length of the stream.

The work, however, cannot be permanent, as new obstructions, caused by floods, caving banks, &c., are brought into the river each year, and require removal to render navigation safe, consequently no detailed estimates for permanent improvement have been submitted.

The wrecks of 11 steamers, sunk during the late war, were removed by contract during 1873–'74. In 1875 and 1877 the United States snagboat O. G. Wagner was employed in removing wrecks and other ob-

structions. The snag-boat John R. Meigs was completed in
1874, and the principal work of improvement since has been
with that boat. The results of the work done are marked.
number of wrecks, and many natural obstructions, which li
[illegible] season, have been removed, and the river is navigabl
[illegible] year.

No work has been done since operations were suspended J
[illegible]. The small balance available for the present fiscal yea
quired for the care and preservation of the snag-boat Meigs
United States property belonging to this improvement.

With the amount asked for the fiscal year ending June 30,
proposed to continue the removal of obstructions to navigation
by shore parties and the snag-boat John R. Meigs, as heretof

The former appropriations are:

By act approved March 3, 1873, applied to the removal of eleven wreck
sunk during the late war……
By act approved March 3, 1875……
By act approved August 14, 1876……
By act approved June 18, 1878……
By act approved March 3, 1879……
By act approved June 14, 1880……
By act approved March 3, 1881……
By act passed August 2, 1882……
By act approved July 5, 1884……
Amount expended to June 30, 1886……

Money statement.

July 1, 1885, amount available……
July 1, 1886, amount expended during fiscal year, exclusive of liabilitie
outstanding July 1, 1885……

July 1, 1886, amount available……
Amount appropriated by act approved August 5, 1886……

Amount available for fiscal year ending June 30, 1887……

Amount that can be profitably expended in fiscal year ending June 30, 188
Submitted in compliance with requirements of section 2 of river and
harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

During the past fiscal year 7 steamboats, drawing from 4 to 6 feet of
with carrying capacities ranging from 150 to 300 tons, plied in this strea
these boats each towed a barge of 200 tons capacity. The river was na
entire year, and the boats made one hundred and sixty-eight trips, or ar
twenty-four trips for each boat from Vicksburg to the head of the river.

A small steamer of 32 tons and 3 feet draught of water made 84 trips in

The following freights were carried:

Cotton	bales	76,150	Staves	numb
Cotton-seed	sacks	271,500	Cattle	do
Hides	pounds	27,500	Hogs	do
Wool	do	2,900	Lumber and timber	feet, B.
Tallow	do	5,000	Wood	cor

Return freights of general merchandise and plantation supplies, estin
$2,320,000.

In addition to the above, the commerce of Big Sunflower and Tallaha
and other tributaries, passes up and down this stream.

T 12.

IMPROVEMENT OF BIG SUNFLOWER RIVER, MISSISSIPPI.

This river has its source in Mud Lake, Coahomo County, Mississippi; flows in a southerly direction, and enters the Yazoo River about 55 miles above the mouth of the latter. During extreme high water it is navigable to Clarksdale, Miss., 280 miles above the mouth. Faisonia, 144 miles from the mouth, is ordinarily considered the head of low-water navigation.

An examination was made by the United States in 1878, and the plan adopted for the improvement consisted in building wing-dams, where necessary, to scour a channel of from 3 feet to 40 inches depth, and the removal of snags, sunken logs, and leaning timber obstructing navigation, at an estimated cost of $66,000.

Work was begun in 1879, at which time a boat could not make a trip under ten days, and often fifteen days. After the completion of the work of 1884-'85, it was not a difficult matter to make a trip in six days at the lowest stages. In 1879 there were but 18 or 20 inches of water on the crossings at Oliphant's Bar (eleven in all); during the low-water season of 1884, at no time was there less than 33 inches on the same, and on some of them over 3 feet. The work, however, is not permanent, as, owing to sliding and caving banks and the formation of new bars, obstructions to navigation are added from time to time.

No work has been done since operations were suspended for lack of funds in January, 1885, and numerous additional obstructions have formed since that time.

With the amount asked for the fiscal year ending June 30, 1888, it is proposed to continue the removal of snags, logs, and overhanging trees obstructing navigation, and the construction and repair of wing-dams where required.

The former appropriations are:

By act approved March 3, 1879	$20,000
By act approved June 14, 1880	8,000
By act approved March 3, 1881	4,000
By act passed August 2, 1882	5,000
By act approved July 5, 1884	5,000
Amount expended to June 30, 1886	42,000

Money statement.

July 1, 1885, amount available	$45 38
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	45 38
Amount appropriated by act approved August 5, 1886	5,000 00
Amount (estimated) required for completion of existing project	19,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	15,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

During the fiscal year boats have not gone higher up than William's Landing, about 210 miles above the mouth, to which point the river has been navigable since January 1, 1886. Johnsonville has been the upper limit of low-water navigation. The river has been navigable the entire year, and two steamboats have plied in the stream; the Headlight, drawing 4½ feet of water, loaded, with a carrying capacity of 195 tons, made [illegible] trips, and the Evergreen, drawing 3½ feet, loaded, with about half the capacity of the former, made 49 trips.

The following are the freights carried:

Cotton ....bales..	9,000		Staves..................number..	400,00
Cotton-seed ....sacks..	37,000		Cattle ....head..	1,00
Hides ....pounds..	7,000		Hogs ....do....	40
Wool ....do....	7,000		Lumber and timber.feet, B. M..5,000,00	
Tallow ....do....	7,000		Wood ....cords..	1,20

Return freights, [illegible] tons, general merchandise and plantation supplies; estimated [illegible].

T 13.

IMPROVEMENT OF TCHULA LAKE, MISSISSIPPI.

Where the Yazoo River reaches the head of Honey Island, about 2 miles above its mouth, it divides into two branches, the westerly on retaining the name of the river, while the easterly and narrower branc is named Tchula Lake or River. The distance from the head to the foo of the island, where the two branches again unite, is about 67 miles.

The country along the lake is highly cultivated, and very productiv plantations join one another along its banks. The amount of cotto raised annually is estimated at about 20,000 bales, which formerly wa brought to market via the Yazoo River and Tchula Lake, or carried b wagons long distances to the southern division of the Illinois Centr Railroad. During the year this road has begun the construction of line from Yazoo City to the mouth of the Yallabusha River, whic touches Tchula Lake at several points, and has a tap line from Tchu City to the main line at Durant, Miss. It is expected that this new li will be open for traffic next autumn, and it will no doubt transport mo of the cotton which has to be marketed before navigation opens in t lake.

An examination was made by the United States in 1879, and the pro ect based thereon contemplated the removal of snags, logs, overhan ing trees, &c., obstructing navigation, to enable light draught boa to enter the lake earlier in the season. The estimated cost of this i provement was $10,000. Work was begun in 1881 and continued 1882 and 1884. Navigation has been greatly improved by the remov of overhanging timber, snags, &c., and boats have been enabled to ent the lake earlier and run much later during the season. Much wor however, remains to be done to benefit navigation during medium stag As new obstructions are continually forming, the improvement cann be said to be permanent, and appropriations will be needed from ti to time if the stream is to be kept in a navigable condition.

Nothing has been done since operations were suspended in Februar 1885, for lack of funds.

Should an appropriation be made for the fiscal year ending June 3 1888, it is proposed to continue the removal of bank and channel o structions as heretofore.

As this stream is really nothing but a branch of the Yazoo River, it recommended that future appropriations for its improvement be includ in the general appropriation for the Yazoo River.

The former appropriations are:

By act approved March 3, 1881	$3,000
By act passed August 2, 1882	2,500
By act approved July 5, 1884	1,500
Amount expended to June 30, 1886....................................	6,846

Money statement.

July 1, 1885, amount available	$425 84
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	272 60
July 1, 1886, amount available	153 24
Amount appropriated by act approved August 5, 1886	2,000 00
Amount available for fiscal year ending June 30, 1887	2,153 24
Amount that can be profitably expended in fiscal year ending June 30, 1888 Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	5,000 00

COMMERCIAL STATISTICS.

During the fiscal year three steamboats, drawing from 4 to 6 feet, loaded, with carrying capacities of from 200 to 300 tons, navigated this stream from December to June, inclusive, carrying the following freights:

Cotton	bales	13,000
Cotton-seed	sacks	35,000

Return freights of general merchandise and plantation supplies; estimated value $360,000.

T 14.

IMPROVEMENT OF TALLAHATCHEE RIVER, MISSISSIPPI.

The headwaters of this river are in Tippah and Union counties, in the northern part of Mississippi. It flows in a southwesterly direction until joined by the Coldwater River, in Quitman County; thence, as the main stream, it flows in a southerly direction, and, uniting with the Yallabusha River, in Le Flore County, the two form the Yazoo River.

An examination was made by the United States, and report submitted in January, 1879. The project based thereon contemplated the removal of snags, sunken logs, and overhanging timber obstructing low-water navigation from its junction with the Coldwater to the mouth, a distance of 165 miles, and also the removal of the wreck of the steamer Star of the West, lying in the channel 8 miles above the mouth. The estimated cost of such improvement was $40,000. An additional examination was made in 1880 to obtain further information in regard to the river.

Work was begun in 1879 and continued during 1880, 1881, 1882, and 1884. Part of the appropriations of 1880 and 1881 and the entire appropriation of 1882 ($10,000 in all) were expended above the mouth of Coldwater to Batesville, as required by the appropriation acts. This portion of the river, however, was not included in the original estimate of cost.

The work done has resulted in the removal of a large number of obstructions and greatly increased the capacity of the river for navigation. Previous to improvement the river was navigable from the mouth of Coldwater to the Yazoo about six months of the year. Boats from the Yazoo are now enabled to run to Sharkey's Landing, 100 miles above the mouth, during the entire year, but rarely go above that point at any stage, their owners claiming that the amount of commerce will not justify the expense of a longer trip. Many dangerous obstructions yet remain in the river, the removal of which would greatly benefit navigation

New obstructions, caused by sliding and caving banks, are also con [illegible] forming, and no permanent improvement can be effected on [illegible]. It is important, however, to planters and others living al the banks of the river that it should be kept in good navigable co tion, as it is the only available outlet for their products and retur supplies.

No work has been done since operations were suspended and the fu [illegible] December, 1884.

With the amount asked for the fiscal year ending June 30, 1888, [illegible] to continue the removal of obstructions from the channel [illegible] as heretofore. Should the whole amount be appropriated, work could be carried on in both sections of the river.

The former appropriations are:

By act approved March 3, 1879	$6
By act approved June 14, 1880	9
By act approved March 3, 1881	3
By act passed August 2, 1882	3
By act approved July 5, 1884	3
Amount expended to June 30, 1886	$4
Above mouth of Coldwater	10
Below mouth of Coldwater	14

Money statement.

Amount appropriated by act approved August 5, 1886	$3,50
Amount estimated required for completion of existing project	22,5
Amount that can be profitably expended in fiscal year ending June 30, 1888	10,0

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

The [illegible] was navigable to Sharkey's Landing during the entire fiscal [illegible] the Yazoo, drawing from 4 to 6 feet, loaded, and with carr [illegible] to 300 tons, pliedin the stream, making one hundred [illegible] an average of twenty-four trips for each boat. Three of t [illegible] of 200 tons capacity.

[illegible] were carried:

[illegible]	head	
[illegible]	bales	26
[illegible]	sacks	23
[illegible]	pounds	25
[illegible]	do	3
[illegible]	do	7
[illegible]	head	
[illegible]	feet, B. M	1,900
[illegible]	number	410
[illegible]	cords	

[illegible] merchandise and plantation supplies; estimated va [illegible]

T 15.

[illegible] OF YALLABUSHA RIVER, MISSISSIPPI.

[illegible] small stream, about 90 miles in length. It [illegible] County, Mississippi, flows through Grenada [illegible] unites with the Tallahatchee at a point 3 mi [illegible] forming the Yazoo River.

An examination was made in 1879, and the plan of improvement consisted in the removal of snags, sunken logs, leaning timber, &c., obstructing navigation from Grenada, Miss., to the mouth, a distance of 63 miles. An examination of the river above Grenada was made in 1882, and that portion was found to be narrow, shallow, and much obstructed, and was not considered worthy of improvement. The Illinois Central Railroad Bridge and a highway bridge crossing the river at Grenada are barriers to navigation above that point. The original estimate of cost of improvement was $7,000. It was found, however, that additional funds would be required from time to time for the removal of new obstructions, caused by caving banks, &c.

The improvement was begun in 1881, and continued during 1882, 1883, and 1884, and has resulted in making the stream navigable during five or six months of the year, or at high and medium stages of water.

Nothing has been done since December, 1884, when the available funds were exhausted.

Should an appropriation be made for the fiscal year ending June 30, 1888, it is proposed to continue the removal of obstructions from the channel and banks as heretofore.

The former appropriations are:

By act approved March 3, 1881	$3,500
By act passed August 2, 1882	3,500
By act approved July 5, 1884	2,000
Amount expended to June 30, 1886	9,000

COMMERCIAL STATISTICS.

The river was navigable from Grenada to the mouth during about six months of the fiscal year. No steamboats navigated the stream within this time, and no reliable commercial statistics could be obtained.

Money statement.

Amount appropriated by act approved August 5, 1886	$2,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888 Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	5,000 00

T 16.

IMPROVEMENT OF STEELE'S BAYOU, MISSISSIPPI.

This bayou is a tributary of Yazoo River. It has its source in Swan Lake, Washington County, Mississippi, flows in a southerly direction parallel to the Mississippi River, and enters the Yazoo about 12 miles above its mouth, and generally it is not navigable except when the Mississippi River is high enough to fill the lower portion of the bayou with its backwater.

An examination was made by the United States in 1880. No estimate of cost of improvement was submitted by the United States Engineer officer in charge, but his assistant, who made the examination, reported the probable cost at $14,960.

The only appropriation for this improvement was made by river and harbor act of July 5, 1884, $2,500.

[illegible] consisted in the removal of the principal obstructio [illegible] were begun at the foot of Swan Lake and continue [illegible] mouth. After reaching Murray's Ferry, about 4 [illegible] mouth, the stream was at such a high stage that wor [illegible] principally to the removal of leaning trees, whic [illegible] the funds were exhausted. This work has bene [illegible] navigation principally. Much remains to be done b [illegible] medium stages can become practicable and profitabl [illegible] the bayou and the borders of Lake Washingto [illegible] furnish the products which are shipped through i [illegible] subject to overflow from backwater, and not muc [illegible] under cultivation. The west side of Lake Was [illegible] the Mississippi River, and a branch of the Loui [illegible] and Texas Railroad extends from Greenville sout [illegible] county line, whence it will probably be continued t [illegible] Rolling Fork. This is located between Swan Lak [illegible] and will no doubt absorb much of the carryin [illegible] otherwise be tributary to Steele's Bayou.

[illegible] since operations were suspended in Februar [illegible] funds.

[illegible] asked for the fiscal year ending June 30, 1888, it [illegible] the removal of obstructions from the channel an

Money statement.

[illegible]	$125
[illegible] expended during fiscal year, exclusive of liabilities [illegible]	120
[illegible]	5
[illegible] act approved August 5, 1886	2,500
[illegible] fiscal year ending June 30, 1887	2,505
[illegible] profitably expended in fiscal year ending June 30, 1888 [illegible] in compliance with requirements of section 2 of river and [illegible] act of 1887.	5,000

COMMERCIAL STATISTICS.

[illegible] from February to May, inclusive, during the past fis [illegible] tons and drawing 3½ feet loaded, towing a barge of 1 [illegible] made 4 trips into the stream. Another steamboat, of 1 [illegible] towing three barges, one of 200 tons and the oth [illegible] to 5 feet of water, made 9 trips. [illegible] were carried:

87. [illegible]	bales	1
[illegible]	sacks	30,
[illegible]	pounds	1
[illegible]	do	1,
[illegible]	head	1
[illegible]	do	1
[illegible]	feet, B. M.	3,000,
[illegible]	cords	1,
[illegible] general merchandise and plantation supplies		150,

The

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above Gr

T 17.

IMPROVEMENT OF BIG BLACK RIVER, MISSISSIPPI.

This stream rises in Webster and Choctaw counties, Mississippi, flows in a general southwesterly direction, and enters the Mississippi River at Grand Gulf, Miss., having an estimated length of about 400 miles.

The bridge of the Louisville, New Orleans and Texas Railroad, about 15 miles above the mouth, and that of the Vicksburg and Meridian Railway, about 90 miles above the mouth, neither having draws, form obstructions to free and safe navigation at all stages of water. Two highway bridges without draws, respectively, 25 and 78 miles above the mouth, also form barriers to navigation. The river above the first railroad bridge at present is navigated only by flat-boats carrying staves, &c.

Old settlers assert that previous to the building of the railroads, large quantities of cotton and produce were shipped annually down the river in flat and keel boats, and it is probable that if the bridge obstructions were remedied, and the bank and channel obstructions removed, at least a portion of the commerce of the country bordering the river would find a way to market by this route to the Mississippi River. Owing to the comparatively short distances between points on lower Big Black River and the different railroads which border and cross it, as well as its proximity to the Yazoo River at Satartia, it is impossible to form any estimate of the benefits to be derived from the thorough improvement of the river between Cox's Ferry and its mouth.

An examination of the stream was made by the United States in 1881, and the project for its improvement contemplated the removal of snags, logs, overhanging timber, and several wrecks obstructing navigation, from the mouth to Cox's Ferry, a distance of 130 miles, at an estimated cost of $32,000.

The only appropriation for this improvement ($5,000) was made by river and harbor act of July 5, 1884. Operations were begun at the mouth in October, 1884, and continued up stream for a distance of 75¼ miles. This work resulted in the removal of the principal obstructions from the banks and channel, and greatly increased the facilities for navigation on that portion of the river in which it was done.

No work was done during the fiscal year, as the balance available was insufficient to resume operations, if it had been considered advisable to do so.

While the present artificial obstructions remain, the stream will be obstructed at all stages, hence the removal of natural obstructions would only facilitate flat-boat and stave-boat navigation. For these reasons it is thought that for the present no additional funds are required for the improvement of this river.

Money statement.

July 1, 1885, amount available	$879 73
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	621 35
July 1, 1886, amount available	258 38
Amount appropriated by act approved August 5, 1886	5,000 00
Amount available for fiscal year ending June 30, 1887	5,258 38
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	22,000 00

COMMERCIAL STATISTICS.

During the fiscal year six boat-loads of staves, aggregating a total number of about 200,000, were brought out of this stream. These boats are from 120 to 175 feet long by 25 feet wide, and have an average draught of water of 7 feet loaded.

A small steamboat, with a carrying capacity of about 150 tons and drawing about 3 feet of water loaded, made three trips into the lower river during June, lowering her chimney to pass under the Louisville, New Orleans and Texas Railroad Bridge. This boat brought out about 400 sacks of cotton-seed, and carried some return freights, consisting of general merchandise and plantation supplies.

T 18.

IMPROVEMENT OF BIG HATCHEE RIVER, TENNESSEE.

This river has its source in Northeastern Mississippi, flows in a north westerly and then westerly direction, through the most productiv region of West Tennessee, and enters the Mississippi River at the junc tion of Lauderdale and Tipton counties, Tennessee, about 50 miles b river above Memphis.

An examination of the stream was made by the United States i 1879. The project for its improvement contemplates the removal o logs, snags, leaning timber, &c., obstructing navigation from Boliva Tenn., to the mouth, a distance estimated at 240 miles. This woul render the river navigable for light draught boats throughout the yea The estimated cost of this improvement was $30,000.

The improvement of this stream was begun in 1880, and continue during 1881, 1882, and 1884. Before its commencement navigation wa almost impossible. The work done has benefited commerce by allo ing the shipment of products by river, whereas previously the railroad had a monopoly of the carrying trade.

Nothing has been done since the work was suspended, on account high water, in February, 1885, the balance available being insufficie to resume operations in the stream.

With the amount asked for the fiscal year ending June 30, 1888, it i proposed to continue the removal of channel and bank obstructions a heretofore.

The former appropriations are:

By act approved June 14, 1880	$10,000
By act approved March 3, 1881	3,500
By act passed August 2, 1882	3,000
By act approved July 5, 1884	2,500
Amount expended to June 30, 1886	18,766

Money statement.

July 1, 1885, amount available	$788
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	555
July 1, 1886, amount available	233
Amount appropriated by act approved August 5, 1886	3,000
Amount available for fiscal year ending June 30, 1887	3,233
Amount (estimated) required for completion of existing project	8,000
Amount that can be profitably expended in fiscal year ending June 30, 1888	8,000

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

The boats in this stream ply up and down, discharging a large proportion of their freights at the railroad crossing, and making occasional trips to Memphis, hence full commercial statistics could not be obtained. It has been ascertained, however, that the river was navigable for about seven months of the fiscal year. Three steamboats, three tugs, seven barges, and numerous wood-rafts, drawing from 2 to 4 feet of water, navigated it during that time, the steamers having capacities of from 100 to 125 tons each, and the barges 50 tons each.

The following freights were carried:

Cotton	bales..	5,000
Cotton-seed	sacks..	25,000
Staves	number..	1,200,000
Lumber	feet, B. M..	900,000
Wood	cords..	20,000

T 19.

IMPROVEMENT OF SOUTH FORKED DEER RIVER, TENNESSEE.

This river heads in McNairy and Henderson counties, Tennessee, and, flowing in a general northwesterly direction, joins the main Forked Deer River 8 miles below Dyersburg, Tenn. The commerce of the country through which it passes is considerable, and before the introduction of railroads was carried upon this stream to the Mississippi River. Of late years, however, the railroads have diverted the transportation of a large portion of the products in other directions. Two railroads and five county bridges, all without draws; a log boom at Hosier Mill, about 100 miles above the mouth, and a brush dam, 13 miles below Bell's Depot, and about 130 miles above the mouth, which deflects the main body of the river into an artificial channel for the use of private parties, all form serious obstructions to the navigation of this river. Owing to these obstructions, the navigation is principally by means of flat-boats that can pass under the bridges.

An examination of the river was made by the United States in 1880, and the project for its improvement contemplated the removal of snags, logs, leaning timber, and similar obstructions to navigation, at an estimated cost of $19,250. The original plan contemplated improving the river from Sharon to the mouth (about 114 miles), only, but operations have been carried up to Jackson, Tenn., the head of navigation, 81 miles above Sharon.

Work was carried on during 1883 and 1884, and a large number of obstructions, principally overhanging timber, were removed between the mouth and Jackson, which greatly increased the facilities for navigation. As long as the artificial obstructions remain the whole river cannot be made navigable for steamboats, but the portion below the lower obstruction, about 100 miles above the mouth, and the reach from Bell's Depot to Jackson, about 60 miles, can be improved in the interest of steamboat navigation.

Nothing has been done since December, 1884, when the funds for this improvement were exhausted.

Should an appropriation be made for the fiscal year ending June 30, 1888, it is proposed to continue the removal of obstructions from the channel and banks as heretofore.

The former appropriations are:

By act passed August 2, 1882	$3,000
By act approved July 5, 1884	2,000
Amount expended to June 30, 1886	5,000

Money statement.

Amount appropriated by act approved August 5, 1886 ....

Amount (estimated) required for completion of existing project ....
Amount that can be profitably expended in fiscal year ending June 30,188
Submitted in compliance with requirements of section 2 of river an
harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

During the fiscal year the stream was navigable from December to Jun merce was carried on principally by steamboat, drawing 3 feet of wate The following were brought out of the river:

Staves ....number
Lumber..feet, B. M
Wood...cords

T 20.

WATER-GAUGES ON THE MISSISSIPPI RIVER AND ITS PRINCIP TARIES.

By joint resolution of Congress approved February 21, 187 retary of War was directed "to have water-gauges established observations made of the rise and fall of the Lower Mississi and its chief tributaries at or in the vicinity of" certain specifi

During the fiscal year daily observations have been made lowing stations:

Alexandria, La., on Red River; Baton Rouge, La., on M River; Cairo, Ill., at junction of Mississippi and Ohio rivers; C La., on Mississippi River; Florence, Ala., on Tennessee Ri Leavenworth, Kans., on Missouri River; Helena, Ark., on M River; Jacksonport, Ark., on White River; Lake Providenc Mississippi River; Little Rock, Ark., on Arkansas River; l Ky. (two, upper and lower), on Ohio River; Memphis, Tenn sissippi River; mouth of White River, Arkansas, on Mississi Nashville, Tenn., on Cumberland River; Natchez, Miss., on M River; Red River Landing, La., on Mississippi River; Saint L on Mississippi River; and Vicksburg, Miss., on Mississippi I

These gauges were established by Maj. William E. Merrill Engineers, during the latter part of 1871, except those at Carro established January, 1872, and at Nashville, Tenn., August,

Regular observations were commenced at each station as s gauge was established, and have been continued regularly sin a complete record of daily readings at all the stations (with ceptions), has been obtained from January, 1872, to the pres In 1881 bulletin-boards were erected at all stations on the M for the purpose of giving to steamboats the stage of water e ing.

During the fiscal year the gauges at the following points ha spected either by myself or under my direction: Memphis, V Carrollton, Louisville, Nashville, Florence, Jacksonport, Li and Alexandria.

A new gauge was put up at Jacksonport, and the high-water section of the gauge at Nashville was reconstructed and new bench-marks located and marked. In addition to the above the Mississippi River Commission has inspected the gauges on the Mississippi River and made the necessary repairs. Records of the daily readings of the gauges have been furnished the Mississippi River Commission, and a copy of the Carrollton gauge record has been furnished the assistant engineer in local charge of the examination and survey of the South Pass of the Mississippi River. Hydrographs of all gauges were made, but retained in this office.

Copies of the gauge records at all the stations are transmitted herewith.

In accordance with the joint resolution approved February 21, 1871, referred to above, the sum of $5,000 was to be appropriated annually for these gauges. As no appropriation was made for the past fiscal year, and the amount available was not sufficient to maintain all the gauges, the Mississippi River Commission has paid the observers at the gauge stations on the Mississippi River, to prevent the suspension of those important observations.

Money statement.

July 1, 1885, amount available	$2,117 53
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	1,866 39
July 1, 1886, amount available	251 14
Amount appropriated by act approved August 5, 1886	5,000 00
Amount available for fiscal year ending June 30, 1887	5,251 14
Amount that can be profitably expended in fiscal year ending June 30, 1888 Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	5,000 00

Comparison of flood of 1886 *with highest water previously recorded at the different stations.*

Stations.	Highest water previously recorded.		Highest water of 1886 to June 30.		Relation to previous highest record.	
	Year.	Gauge reading.	Date.	Gauge reading.	Below.	Above.
		Feet.		*Feet.*	*Feet.*	*Feet.*
Cairo	1883	52.17	April 19	50.98	1.19	....
Memphis	1882	35.15	April 28	34.80	.35	....
Helena	1882	47.20	April 30	48.10	....	.90
Mouth of White River	1882	48.40	May 4	48.30	.10	....
Lake Providence	1862	40.87	May 7	37.91	2.96	....
Vicksburg	1862	51.10	May 7 to 9	44.15	6.95	....
Natchez	1862	50.30	May 9 to 11	43.75	6.55	....
Red River Landing	1882	48.50	May 31	41.94	6.56	....
Baton Rouge	1884	36.20	May 31 to June 2.	32.10	4.10	....
Carrollton	1862	15.90	May 31	13.80	2.10	....
Saint Louis	1844	41.39	May 13	27.00	14.39	....
Louisville (upper)	1884	46.60	April 10	32.75	13.85	....
Louisville (lower)	1884	72.00	April 10	58.45	13.55	....
Fort Leavenworth	1881	26.75	March 26	15.80	10.95	....
Nashville	1882	55.30	April 10	49.50	5.80	....
Florence	1867	31.08	April 8	28.10	2.98	....
Jacksonport	1867	32.83	May 12	24.00	8.83	....
Little Rock	1857	31.00	February 16	17.90	13.10	....
Alexandria	1866	36.46	June 17	27.90	8.56	....

APPENDIX U.

IMPROVEMENT OF ARKANSAS RIVER; OF RIVERS IN THE STATE OF ARKANSAS, AND OF BLACK RIVER IN ARKANSAS AND MISSOURI.

REPORT OF CAPTAIN H. S. TABER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1886, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Removing obstructions in Arkansas River, Arkansas.
2. Arkansas River at Pine Bluff, Arkansas.
3. Black River, Arkansas and Missouri.
4. White River, Arkansas.
5. White River above Buffalo Shoals, Arkansas.
6. Saint Francis River.
7. Saline River, Arkansas.
8. L'Anguille River, Arkansas.

SURVEYS.

9 Survey of Arkansas River, Arkansas, from Little Rock to its mouth.

10. Continuation of the survey of Arkansas River from Wichita, Kansas, to Fort Gibson, Indian Territory.

UNITED STATES ENGINEER OFFICE,
Little Rock, Ark., July 1, 1886.

GENERAL: I have the honor to transmit herewith the annual reports for the fiscal year ending June 30, 1886, upon the works under my charge.

I am, general, very respectfully, your obedient servant,

H. S. TABER,
Captain of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

U 1.

REMOVING OBSTRUCTIONS IN ARKANSAS RIVER, ARKANSAS.

As the first expenditure of money on this river was made as early as 1833, it is not an easy matter to determine what was the original condition of the navigable portion of this stream; but from the delta-like upper reaches it may be inferred on very substantial grounds that shifting sand-bars, numerous drift piles, and dangerous snags characterized the obstacles to navigation in the lower reaches, and gravel and rock shoals, with a few snags and many overhanging trees, constituted those of the kept so at medium stage of water (not the year round, on account of bars) had $36,000 been available. As it is, boats have picked their way through snags in an uncertain way. One has been sunk, and others damaged, and confidence in river navigation destroyed.

While no permanent results can be secured except by carrying out the details of the plan submitted in my last annual report for the permanent improvement of the river, yet until that is accomplished there should be an assured annual appropriation to keep the river free of snags, in the interests of the constantly increasing commerce, of at least $35,000.

As to commercial statistics, please refer to the head "Survey of the Arkansas River from Little Rock to its mouth," in addition to what is given below.

In two years there has been a most remarkable interest developed in industries of all kinds, and this State is like a young State in many respects.

The people are awake, but as yet do not present facts as to commerce that really are to be had, so that all that appears here is much below what could be given, and which will appear as soon as systematic records are kept.

Since but $19,875 was appropriated by act approved August 5, 1886, the river will become so obstructed that it will require at least $50,000 to maintain a channel during the fiscal year ending June 30, 1888.

The amount ($75,000) appropriated by act approved August 5, 1886, is too small to have any appreciable effect in reducing the amount of snagging operations required during the years ending June 30, 1887, or 1888.

Prompt attention to the permanent improvement would save these heavy outlays for snagging, that have to be repeated annually to keep the channel open.

Attention is specially invited to this matter, as there is a great chance here for practical economy, so far as this river goes.

Money statement.

July 1, 1885, amount available		$7,631 21
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$6,321 11	
July 1, 1886, outstanding liabilities	297 00	
		6,618 11
July 1, 1886, amount available		1,310 10
Amount appropriated by act approved August 5, 1886		19,875 00
Amount available for fiscal year ending June 30, 1887		21,185 10

Amount (estimated) required for completion of existing project annually until permanent improvements are effectively begun	35,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	50,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

EXPENSE ACCOUNT, REMOVING OBSTRUCTIONS IN ARKANSAS RIVER, ARKANSAS AND KANSAS.

Pay-rolls, labor, &c	$5,594 86
Subsistence supplies	315 15
General supplies	177 21
Traveling expenses	30 08
Stationery	6 14
Fuel	136 17
Office rent	60 00
Freight charges	1 50
Total	6,3[illegible]

COMMERCIAL STATISTICS.

The commerce referred to here relates principally to the reach between
and Fort Smith, where, owing to the incomplete state of the maps, no p
yet been made for anything but snagging operations.

OFFICE OF JENKINS & PARKE
COTTON-BUYERS AND GENERAL MERCI
Paris, Ark., Ju

DEAR SIR: Our Mr. E. E. Jenkins is out of place just now, and left the
asked for in yours of 21st instant for us to deliver; and our estimate sho
mately, $150,000 goods sold, 3,246 bales cotton bought, 1,160,000 pounds
received, exclusive of business done by four blacksmith shops, one good
grist mill, three steam cotton-gins.

All our houses except one shipped some cotton by river last season,
river navigation from October 1, 1885, to February 1, 1886, 25 per cent.
was shipped by boat. About 40 per cent. of the freights received thi
have been by river, and with good navigation the year round 90 per cen
received and shipped by our town would be by boat.

The difference in freights by river and rail is about 20 to 25 cents per
favor of river.

From best showing we can get from other points, asked for, we give al
of pounds freights received and bales cotton shipped, and you can pro rat
ment above to arrive at value of business.

Locality.	Frei recei
	Pou
Roseville	300,
Patterson's Bluff	150,
Morrison's Bluff	180,
Prairie View and Ellsworth (inland)	300,

Charleston does about 20 per cent. less business than our town.

Have been unable to get anything from Magazine and Booneville, bo
may be considered river towns and do a considerable business.

Hoping our efforts may prove of value, and joining you in an earnest
for river facilities,

We subscribe ourselves,

JENKINS &

Mr. C. P. W[illegible]

LETTER OF MR. JAMES K. PERRY.

DARDANELLE, ARK., Ju

DEAR SIR: In answer to your request for estimate of business at the
[illegible] the pleasure to give you the following figures, which m
[illegible] estimate of the present business, to wit:

[illegible]

JAMES

[illegible]

U 2.

IMPROVEMENT OF ARKANSAS RIVER AT PINE BLUFF, ARKANSAS.

This reach of river, which lies in the vicinity of Pine Bluff, Ark., was in a very bad condition prior to any attempts at improvement. At one point a cut-off was threatened which would change the slope of the river from three-fourths of a foot per mile to 4 feet per mile. At another point a bad bar interfered with navigation at low water, and in the sharp bend in front of the town of Pine Bluff the river was eroding the banks with a rapidity that threatened to sweep the town from existence. The original project proposed to accomplish three objects, viz:

First. To protect the river bank in front of the town from further erosion.

Second. To rectify the course of the river in the bend above town in order to remove a bar now existing there, * * * and also by diminishing the curvature of the bend to lessen the tendency to excessive scour in front of Pine Bluff.

Third. To prevent the formation of a cut-off now threatened across the peninsula opposite Pine Bluff. * * * The whole improvement to extend over 13 miles of river.

Up to June 30, 1884, $67,287.14 had been expended with the above objects in view. Three thousand nine hundred feet of the town front, beginning at Brump's Bayou, was revetted during 1881. Three thousand seven hundred feet of Yell's Bend was revetted the same year to prevent the cut-off, and a wire curtain dike 1,110 feet long was put in to affect the bar. In 1882 3,000 feet more of Yell's Bend was revetted, and in 1883 the old works were repaired, 3,000 feet of bank in Yell's Bend was regraded, and 1,000 feet of high-water protection put in place. During the fiscal year ending June 30, 1884, little was done except to care for plant. July 1, 1884, there remained of all this work only the wire curtain dike. This result was predicted by the various engineers in charge, inasmuch as the works had to be left in an unfinished state owing to failure of funds.

The work in Yell's Bend had, however, a long life to delay the advance of the river until changes above rendered the danger less imminent. The wire curtain dike did good service, and the bar was much improved. The town, however, was left at the mercy of the river.

During the fiscal year ending June 30, 1885, $48,813.98 was expended in building 2 dikes, one 1,520 feet and the other 251 feet in length, as fully set forth in my last annual report. These two dikes successfully arrested the caving banks, and at this writing are in excellent condition and meeting every expectation. During the fiscal year ending June 30, 1886, two short dikes were placed in front of the town to increase the deposit at an expense of $2,150.61. The balance was held as a contingent to watch the ever-changing regimen of the river. The blocks at the lower end of the town are as yet unprotected, and to give absolute security the dikes placed in 1884–'85 should be extended, but it was not deemed wise to expend the balance until a farther contingent fund should be available, inasmuch as it will be some years before the river will have a settled course. Indeed, it cannot have until it is permanently improved upon. Therefore, so long as a change in the regimen above is likely to cause the river to move down upon this peculiar reach and attack the banks in an entirely new quarter, so long will it be necessary to have a contingent with which to guard the works. Just

U 3.

IMPROVEMENT OF BLACK RIVER, ARKANSAS AND MISSOURI.

Before any improvements were made upon this river, its channel was choked with logs and snags, and obstructed by overhanging trees, and in many places shoals interfered with its navigation at low water by any but very light-draught boats.

Its banks caved but little, and, except at the shoals, it was characterized by greater depth of water than is found in streams generally in the vicinity, due to its being narrow and its banks firm.

The original plan for its improvement contemplated the removal of the obstructions and the improvement of the shoals, the latter by wing-dams. A few sloughs were to be closed up so as to confine the water to the main channel.

Up to June 30, 1885, $49,610.80 had been expended in carrying out the above plan. This expenditure gave great relief to navigation, especially that made in the year ending June 30, 1885, inasmuch as the new snag-boat operated in that year.

It is to be regretted that no appropriation was made available for the year ending June 30, 1886, as some of the good effects of the work the previous year were lost, owing to there not being funds to open up the upper river. Nothing has been done during the fiscal year ending June 30, 1886, the funds sufficing only to preserve the property. Snagging operations in this stream, as in others of similar character in this district, have to be repeated annually, though not so much so in this particular river as in some others, on account of the more permanent character of its banks.

There are a few shoals that should be improved by wing-dams and possibly a few chutes that need closing. Taking all these facts together, it is estimated that $10,000 could be profitably expended during the fiscal year ending June 30, 1888. It is believed that after this river is thoroughly opened up, a sum not to exceed $8,000 a year will keep it open to navigation, until the country becomes cleared up, when a less sum would suffice, on account of the smaller number of snags likely to be brought in annually.

Since by act approved August 5, 1886, only $5,000 were appropriated, $15,000 could be profitably expended in the year ending June 30, 1888.

Money statement.

July 1, 1885, amount available		$1,624 10
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$1,121 32	
July 1, 1886, outstanding liabilities	145 00	
		1,266 32
July 1, 1886, amount available		502 78
Amount appropriated by act approved August 5, 1886		5,000 00
Amount available for fiscal year ending June 30, 1887		5,502 78

Amount (estimated) required for completion of existing project, an annual appropriation of	8,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	15,000 00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

EXPENSE ACCOUNT IMPROVING BLACK RIVER, ARKANSAS AND MIS

Pay-roll, labor, &c. ....
General supplies ....
Traveling expenses ....
Fuel. ....
Rent of office ....
Stationery ....

Total ....

COMMERCIAL STATISTICS.

STEAMER GEORGE W. D

Newport, Ark., J

Replying to your favor of 2d instant relative to amount of business d
will say that Black and Current rivers carry out about 15,000 bales of co
cotton seed, 40,000 bushels corn, 5,000 bushels wheat, about $20,000 worth
bacon, and 700,000 pounds general store merchandise.

The milling interests are large; fully 3,000,000 staves and 20,000,000 fe
handled per year.

At least one-third of the above estimate is brought out of Current Ri
deep, but being narrow is obstructed by overhanging trees and snags,
attention the same as Black River.

Will also state that about 300,000 railroad ties are handled above Blac

Respectfully, yours,

GEORGE (

H. S. TABER,
Captain, U. S. Corps of Engineers.

U 4.

IMPROVEMENT OF WHITE RIVER, ARKANSAS.

This appropriation was made by act approved July 5, 1884,
first separate appropriation made for the entire river, if the
of $10,000, made by act approved March 3, 1879, is excepted.
appropriations made for this river, under any head, was ma
approved March 2, 1833. Summing up all the various works o
ment, it may be inferred that prior to 1833 this river was mu
with drift piles, logs, and snags in its lower portions, and
Batesville up, gravel shoals, rocky crossings, channel bowlders
hanging trees impeded navigation.

In the originally-adopted project snagging operations figure
To these were added blasting operations for ledges and bow
dam building, to remove gravel bars, to close chutes, from tim
as appropriations warranted and commerce required. This
been united so often with the Saint Francis, and again onc
Black and Saint Francis, and once with the Black and Little
Having no records in this office earlier than the first Annual Re
Chief of Engineers, received after the entry of the officer in c
the service in 1878, it is impossible to give exactly how much
expended on the White River to June 30, 1884.

After a careful study of House Ex. Doc. No. 64, Forty-eighth
first session, the approximate amount is set down as not under
and not over [illegible]. This estimate should be given a weig
[illegible] the river was in excellent naviga
[illegible] boats drawing not to exceed 3 feet of water from its
Newport, Ark. From Newport to Batesville there were man

snags, and from Batesville to Buffalo Shoals there were numerous
hoals, rendering navigation very uncertain.

m Buffalo Shoals to Forsythe, Mo., there were many fine reaches
er; but the depth of water on Buffalo Shoals and others less dan-
s prevented any navigation at ordinary stages of water.

first project proper under this separate head was forwarded to
office August 18, 1884, and recived back approved August 25, 1884,
riefly stated, provides that the $35,000 appropriated be "employed
general work of improving the White River, removing snags and
ers and other obstructions to navigation, building wing-dams to
ve shoals, repairs to plant and care of same," and "to survey the
as provided for by my predecessor, accurately, with a view to its
vement from Forsythe, Mo., to as far down as possible, at an ex-
not to exceed $80 per mile," a fixed sum of $11,366 to be set aside
e survey. The survey was begun early in May, 1885. Except when
iterests of navigation required immediate improvements, it was
ed best to do as little work as possible until the survey gave a bet-
ea of where the money could be applied to best advantage.

principal expenditures for improvements made during the fiscal
nding June 30, 1885, were made for that portion of the river lying
en Jacksonport and Buffalo Shoals. There was an unexpended
ce of the appropriation for the "improvement of the White River
en Jacksonport and Buffalo Shoals," available July 1, 1884. When
as exhausted, work was continued for a short time under this head.

survey was pushed forward with much vigor during July and
st, and had reached Newport, Ark., when the amount allotted for
exhausted. This includes a pencil plotting of the notes upon
paper, to give a general idea of where the present funds could be
ded to the best advantage. Some $400, or more, will be required
nplete the notes.

vas thought best to extend the field work as far as possible, and
to personal work in the way of plotting the notes, in order that a
idea might be had of the river at once. A very complete survey
hus made of 248 miles of river at a cost of about $45 per mile. By
ful selection of energetic civil engineers as assistants, nearly dou-
e amount of river contemplated in the appropriation was covered
e survey, and the work further described in the way of improvement
een in every way more thorough than would have been possible
ut the notes, though no time has been found to plot them sufficient-
draw any plan for the permanent improvement of the river.

eed it is doubtful if it were wise to draw such plan until the sur-
hall have been completed to the mouth of the river, when the en-
ver may be studied as a whole; $13,634 is required to complete the
al project for the survey, and as this is a very worthy river, bor-
by a fertile and rapidly developing country, this survey should
npleted without delay.

urgency of the matter is also more apparent when the condition
plant and the presence of the numbers of the old force is consid-

his work is to be done at all it can be most economically done at

rtly after the survey had covered the reach from Calico Rock to
ort a party was put into the field, with all appliances necessary for
ing bowlders and building dams.

ginning at Calico Rock, at a season when extreme low water was
, thorough work was made, providing a narrow channel for boats

drawing not over 24 inches of water down to Batesville, or unti nel has this depth naturally. As far as possible this work w ing with the plan for the permanent improvement which it ha sible to forecast in a general way.

Without making this report too long no adequate idea ca of the economical work that could be done by waiting for e water. At first there was a complaint that a large sum of been appropriated, and there was too much delay in expen when the work was actually done, and the boats began to ru long reach of improved river, no further complaint was hear er many words of congratulation and satisfaction were used of atoning for former action and expression.

The intention was to complete this work through to Buff but the water became so low that the outfit could not get h Calico Rock.

It accordingly worked as above, and shortly after it reac ville, where the party was disbanded, cold weather came on, further work.

With a view to saving expense for steam-power, watch w the river, and the outfit transferred at trifling expense, at hig Buffalo Shoals.

It was not until late in June, 1886, that the water subsid to get at work; at the present writing even more economi being done than below Calico Rock.

The dams at Buffalo Shoals have all been repaired, and t dropping down the river, testing its work as it goes, as it mus low-water channel required (2 feet) before it can drop down. T made up of the very best men of the district, its economical and work is a practical demonstration of what could be done if tions were made continuous until the work of improving any was completed. Of course, the funds at hand only warrant th of a very narrow channel, but as far as possible the work planned as to be in keeping with the plans of permanent imp which will eventually be drawn.

To remove snags in the lower reaches of the river, and to dams and maintain the channel to and above Buffalo Shoals for the permanent improvement can be drawn, will require expenditure of from $8,000 to $10,000. This amount is a recommended, with the reservation that should there be av sum necessary to complete the survey during the year endin 1887, and there be time to prepare plans and estimates for t nent improvement of the river in time for the action of the gress, then, as appears above, this recommendation shall n sidered.

Money statement.

July 1, 1885, amount available	
Received by sale of fuel to officer	
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$18,670 7
July 1, 1886, outstanding liabilities	276 4
July 1, 1886, amount available	
Amount appropriated by act approved August 5, 1886	
Amount available for fiscal year ending June 30, 1887	

Amount (estimated) annually required to maintain present channel	**$10,000 00**
Amount that can be profitably expended in fiscal year ending June 30, 1888	**10,000 00**
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	

EXPENSE ACCOUNT FOR IMPROVING WHITE RIVER, ARKANSAS.

Pay-roll, labor, &c	**$14,885 08**
Subsistence supplies	**2,361 27**
General supplies	**384 88**
Fuel	**284 72**
Traveling expenses	**441 27**
Transportation	**162 59**
Telegraph service	**7 14**
Office rent	**90 00**
Stationery	**53 84**
	18,670 79

COMMERCIAL STATISTICS.

STEAMER JOHN F. ALLEN,
Batesville, June 30, 1886.

DEAR SIR: * * * I submit the following as the amount of business done by steamer John F. Allen on the Upper White River, from September 17, 1885, to June 30, 1886: Delivered at Newport and Batesville, 5,063 bales cotton and 13,277 sacks cotton seed. Up freights, 740 tons general merchandise and 1,200 barrels salt.

Very respectfully,

CHAS. B. WOODBURY.

Capt. H. S. TABER,
Corps of Engineers.

BATESVILLE, ARK, *July* 16, 1886.

FREIGHT CARRIED BY STEAMER HOME SINCE JANUARY 1, 1886, UNTIL MAY 30, 1886.

	Tons.
Cotton brought out	**645**
Other freight brought out	**15**
Freight taken up	**339**
Total	**999**

T. B. STALLINGS.

U 5.

IMPROVEMENT OF WHITE RIVER ABOVE BUFFALO SHOALS, ARKANSAS.

Before any work was ever done on this particular reach the channel at low water was much choked by logs. In many places large bowlders rendered navigation dangerous or impossible, and in numerous places gravel and rock shoals existed, which held the water in pools. In short, it was a stream to which lock and dam or movable dams could only be applied with any permanent success. The first appropriation was one of $50,000 (act approved June 23, 1874), and this applied not only to this reach, but all the way from Jacksonport. This money was expended in removing logs and the most dangerous bowlders and in improving the shoals by wing-dams, but appears to have been more largely expended below this reach, as per Major Suter's report. By an act approved August 14, 1876, $10,000 was appropriated for Buffalo Shoals.

The first separate appropriation under this head was unde proved June 14, 1880, and in amount $20,000, and it was estima the total cost of the improvement would be $101,220, and this was to be largely used in improving shoal places. The next w act approved August 2, 1882, and in amount $4,000.

To July 1, 1885, $23,181.63 had been expended on direct a tions. How much of the others went to this reach cannot mined from the records. This expenditure has relieved naviga much, but was too small in amount to cover only a few miles ately above Buffalo Shoals.

During the year ending June 30, 1886, the small balance was expended in repairing the dams at Buffalo Shoals. This used in the most economical manner possible, as it was applie nection with funds from the general appropriation improving t River. As stated in my last annual report, it was husbanded purpose.

To save repetition, all matter relating to work done on Buffa is placed under the general head "Improving the White Riv The money statement is, however, added here to avoid confus

It may be noted in finishing this, the last report upon this o priation, that there are few places where more lasting bene been conferred upon the interests of commerce than in the w upon Buffalo Shoals, under past appropriations.

Money statement.

July 1, 1885, amount available ....
Received by sale of fuel to officer ....

July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885 ....

EXPENSE ACCOUNT, IMPROVING WHITE RIVER ABOVE BUFFALO SHOALS, A

Pay-rolls, labor, &c ....
Subsistence supplies ....
General supplies ....
Stationery ....
Freight charges ....
Fuel ....
Traveling expenses ....
Office rent ....

U 6.

IMPROVEMENT OF SAINT FRANCIS RIVER, ARKANSAS.

appropriation was made by act approved July 5, 188 separate appropriation made for the entire river. appropriation made for this river under any head was made b March 2, 1883. Summing up all the various works of may be inferred that prior to 1883 this river was muc logs, and snags, and its waters spread out th of sloughs, while overhanging trees added to the navigation. In the originally adopted project snaggin tions figured largely, and attempts have been made to close up some of the many sloughs.

This river has been united so often with the White River and also with the Black River that it is impossible to give exactly how much had been expended upon the Saint Francis River to June 30, 1884. After a careful study of House Ex. Doc. No. 64, Forty-eighth Congress, first session, the approximate amount is set down as not under $70,000 or over $100,000. This estimate should be given 8 in a scale of 10. During the fiscal year ending June 30, 1885, $8,394.68 was expended on this river.

On July 1, 1884, the river was in an excellent navigable condition from its mouth as high as Wittsburg at medium stage of water. During high water boats have been as high as Lester's Landing. From Lester's Landing to Saint Francis the river was very badly choked with drift and divided into many channels, thus cutting off a rapidly developing section from all facilities of transportation.

The first project proper under this head was forwarded to the office of the Chief of Engineers October 21, 1884, and, briefly stated, provides that the $12,000 appropriated be expended in building a strongly-built decked scow, drawing from 10 to 12 inches of water, supplied with suitable appliances for removing obstructions, with accommodations for the working party, and that this boat be run about five months wherever its services were most needed by the interests of navigation, the scow to cost not over $4,000, and her running expenses not to exceed $1,500 per month.

The outfit as outlined above was completed in time to work about forty days in the fiscal year ending June 30, 1885. During the fiscal year ending June 30, 1886, $4,479.05 was expended in the repairs and running expenses of this snag-boat.

As stated in my last annual report, much pains was taken to build a powerful boat, and her success has been in keeping with this thought. She has during the season accomplished results that were pronounced impossible and gone where no boat has ever ventured during low water, opening up a hitherto impassable reach of river, and giving the citizens along the banks a confidence in the ultimate opening of the river by the Government most gratifying to witness. In the midst of her greatest triumph the funds were exhausted, but not until an open, though very narrow channel, had been provided to Saint Francis. All this has settled the question of her adaptability, and it is only a question of time and appropriations when this worthy river can be made a useful artery of trade. It will require about $8,000 per year for several years to accomplish this.

There is no river in the State that is more worthy of improvement in the interests of navigation. The more study I have given the stream and the country the more interesting the study becomes, and the more convincing the arguments in favor of opening up the river. With no transportation except a wagon, a fertile section rapidly settling up between Lester's Landing and Saint Francis would at once pour out through this channel its products, adding many times the sum required for the improvements to the material prosperity of the country.

Whatever decision may be rendered as to the desirability of further expenditure, the river now has a plant of its own peculiarly adapted to its work, and can be cared for at a very small outlay. It would be better to put the river in excellent shape before the plant deteriorates, and it is believed that after a few years of thorough work the river will

The first separ
proved June 14,
the total cost of t
was to be largely
act approved Aug
To July 1, 1885,
tions. How much
mined from the rec
much, but was too
ately above Buffalo
During the year
was expended in rep
used in the most eco
nection with funds f
River. As stated in
purpose.
To save repetition,
is placed under the g
The money statement
It may be noted in t
priation, that there a
been conferred upon t
upon Buffalo Shoals, t

July 1, 1885, amount availal
Received by sale of fuel to

July 1, 1886, amount expend
outstanding July 1, 1885...

EXPENSE ACCOUNT, IMPROV

Pay-rolls, labor, &c.
Subsistence supplies
General supplies
Stationery
Freight charges
Fuel
Traveling expenses
Office rent

IMPROVEMENT OF S

This appropriation was ma
the first separate appropriati
appropriation made for this r
proved March 2, 1833. Summ
ment, it may be inferred that p
with drift-piles, logs, and snag
great variety of sloughs, while
ties of navigation. In the orig

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will be
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in years to come and that
At present the prospect is
for these improvemen
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permanence and that could at
the minimum cost. This
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the commercial statistics
ount of commerce shown by
written I have learned th
i. e., just in advance of the s
Kennett, Mo., to Saint Fr
a crew of twelve men su
days. Immediately afte
the same boat made two tr
her regular freight.

ey statement.

fiscal year, exclusive of liabilitie

August 5, 1886

June 30, 1887

completion of existing project, an
ped to warrant permanent improve

ed in fiscal year ending June 30, 188
ements of section 2 of river an

NG SAINT FRANCIS RIVER, ARKA

COMMERCIAL STATISTICS.

KENNETT, MO., *July* 5, 1886.

We, the undersigned citizens of Missouri, have the honor to state that, after
investigation, we find the commerce of this section that will be benefited by
provement of the Saint Francis River, between Lester's Landing and Saint
alone, may be determined by the following facts, based on actual figures ob-
rom each precinct in the county, and in localities seeking an outlet per river:
acres cotton and 10,000 acres corn planted annually.
thousand bales cotton, 25,000 bushels corn, and 3,500 tons cotton-seed pro-
nnually; will be largely increased this year.
undred tons merchandise, 600,000 staves, and 700,000 feet lumber shipped in
lve months; both lumber and staves increasing.
ry truly, yours,

FULLER BALLARD.

by:
F. SHELTON, merchant, Kennett, Mo.; T. E. BALDWIN, judge of probate and county treasurer, Kennett, Mo.; E. J. LANGDON, president of the county court, Kennett, Mo.; W. G. BRAGG, jr., clerk of the circuit court; D. P. PANKEY, clerk of county court; J. F. DONALDSON, sheriff and collector; J. D. THOMAS, director Transportation Company; C. A. PETTY, director Transportation Company; N. J. MCBRIDE, associate judge county court; JAMES M. DOUGLASS, justice of county court; ELI T. ANDERSON, physician and surgeon, Hornersville, Mo.; W. S. VAN DIVER, planter; JAMES B. HAYDEN, planter; S. L. PHILLIPS, merchant, Kennett, Mo.; S. S. WHITE, merchant, Kennett, Mo.; S. A. SAGE, justice peace, Kennett, Mo.; R. M. FINNEY, attorney, Kennett, Mo.; T. N. MCHANEY, notary public; A. B. MOBLEY, president Dunklin County Transportation Company.

BER,
ptain, United States Corps of Engineers.

LETTER OF MR. Z. T. PURCELL.

GREENWAY, CLAY COUNTY, ARKANSAS, *June* 3, 1886.

letter of May 24 came duly to hand. I can only give you the approximate
the Saint Francis, or the adjacent county of Saint Francis from the
Mississippi County, Arkansas, up to the crossing of the F. and St. L.
commerce is principally moved by wagons, but would go by river if it
tions removed and those sloughs closed, as I wrote you last year, which
for four or five thousand dollars if intelligently and honestly applied.
figures are about the actual amount at present, and would be greater
y certainty of the transportation; especially the staves and lumber
mes greater.
g your letter I have made inquiry and received the opinion of some
d men in this district, and the figures I give is the average; the value
ad:

	$3,150,000
	225,000
ales)	450,000
hels)	300,000
	300,000
bushels)	100,000
	300,000

int Francis station that the commerce above the railroad is equal, if
e is a little steamboat that runs from the railroad about 60 miles up.
facts concerning the river above at present.
tisfactory, I am, yours, &c.,

Z. T. PURCELL.

ed States Engineers.

LETTER OF MR. W. A. MAY.

SUNK LANDS, *June* 23, 1886.

DEAR SIR: Your favor of the 24th ultimo was received some time ago. You request me to furnish you prior to July 1 "as complete statistics of the commerce upon the Saint Francis River as I may be able to secure," &c.

I will state here that owing to the present condition of said river, much of the produce of the country is hauled to the railroads, thereby depriving, to a great extent, the steamboats of an immense amount of freight.

If work should be properly done on Saint Francis Lake and River, such as deepening, straightening, and removing stumps and logs, so as to enable boats to run the entire year, except perhaps the months of June, July, and August, the freight that goes out in other ways would be carried out by the boats, thus giving shippers easier and better facilities for removing their products, and at the same time add from one-third to one-half to the commerce upon the Saint Francis.

You will bear in mind that this is one of the best timbered sections in the Southwest, and that each year vast quantities of walnut, cypress, gum, &c., are floated and boated out of said lake and river, aggregating in value at least a quarter of a million of dollars. Remember, this is only from the (now) head of navigation down.

The head of navigation now is Lester's Landing, in Craighead County, Arkansas.

You cannot scarcely imagine the amount, much less compute the value of the additional timber and other products that would be boated or floated out, if the Saint Francis should be made navigable from said Lester's Landing up to the Saint Francis crossing of the Narrow Gauge Railroad in Missouri.

In addition to this, large quantities of various kinds of staves are being carried out when the water will admit.

G. M. Rosengranz, of Paragould, Greene County, Arkansas, had from two to four steamboats running from Lester's Landing to Mark-Tree during most of the last fall and winter, carrying out staves, but this work is suspended now on account of the low stage of the water. This alone was high up into the thousands.

Many others would engage in similar enterprises if facilities for getting to market were better.

Besides all this, we must take into account at least 5,000 bales of cotton that are produced by the farmers in this section; also, the thousands of bushels of corn and the many other products, such as potatoes, onions, cabbage, &c., which the rich land produces in abundance.

As above stated, much of the cotton—from one-third to one-half—goes to the railroads.

But little corn is shipped, and the reason of this is that the boats cannot run until it is almost winter, and 12 to 20 miles is too far to haul a wagon-load of corn of only 15 or 20 bushels.

Up to now I would say that each year the commerce on Saint Francis Lake and River has been as follows, as nearly as can be approximated, viz: Timber of all kinds, $250,000; staves of all kinds, $150,000; cotton, corn, and other products, $250,000.

This will be below rather than above the aggregate amount of commerce on the Saint Francis Lake and River, from Lester's Landing to Mark-Tree, for any one year during the past five.

While it is slowly increasing, it would almost double itself in one year, in my judgment, if the river and lake were improved so as to enable parties engaged in getting out timber, staves, and other products to enjoy better and easier facilities.

I remain yours, very respectfully,

WILL A. MAY.

Capt. H. S. TABER,
United States Corps of Engineers.

P. S.—By permission I refer you to Rev. William Y. M. Wilkinson, Arnold Stotts, James Stotts, and G. M. Rims for information on this subject.

W. A. MAY.

U 7.

IMPROVEMENT OF SALINE RIVER, ARKANSAS.

Before improvement, this river was obstructed by snags, logs, drift-piles, and overhanging trees, and by shoals. The original plan for improvement contemplated the rendering of its channel navigable as high as practicable, or as commerce demanded, by the removal of these ob-

structions, and then further improvement of the shoals if the
warranted.

There was expended upon this river up to June 30, 1885,
This has given much relief to navigation, and has practica
the river so far as present navigation demands.

During the fiscal year ending June 30, 1886, $404.56 has be
ed in caring for the property.

Until the requirements of commerce are greater than the
it is not recommended than any further appropriation be ma

From $5,000 to $6,000 per year would keep this river in a f
ble condition during medium stages of water for 250 mile
mouth; that is, up to Big Island, should it be required.

Money statement.

July 1, 1885, amount available	
Received by sale of fuel to officers	
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$404 5
July 1, 1886, outstanding liabilities	10 0
July 1, 1886, amount available	
Amount available for fiscal year ending June 30, 1887	

EXPENSE ACCOUNT, IMPROVING SALINE RIVER, ARKANSAS.

Pay-roll, labor, &c	
Traveling expenses	
Stationery	
Fuel	
Office rent	

U 8.

IMPROVEMENT OF L'ANGUILLE RIVER, ARKANSAS.

This river, like all the streams in eastern and southeaster
of Arkansas, before being improved was obstructed by logs,
overhanging trees and the shoals incident to the accumulatio
and logs.

The original plan of improvement, begun in 1879, contempla
moval of these obstacles, and up to June 30, 1885, $13,850.53
expended in such a manner as to remove all obstacles to na
medium stages of water, leaving a balance of $3,149.47.

To properly improve this channel for low-water navigatio
a peculiar outfit with very light-draught, and yet with machi
ble of lifting water-logged saw-logs and light snags. Prior t
1885, this district owned no outfit adapted to this kind of
tween January and May, 1885, such an outfit was built for
Francis River, and as no interests of navigation would suffe
or at least would suffer but little compared with the result
cured by waiting, it was decided to wait until the funds for
the Saint Francis River had been exhaused, and then, un
authority, transfer this outfit to the L'Anguille River. This

There were many interruptions, due to high water, rendering it necessary to discharge the force from time to time, so that the work was not completed.

Two thousand four hundred and seven dollars and eighty cents was expended during the fiscal year ending June 30, 1886. It is expected that by July 15, 1886, the river will have fallen to extreme low water. Two months' work will then be put in and to an advantage hitherto unknown, and it is expected that this will so thoroughly clear the channel from all obstructions that no work will need to be done in many years. As the river now is, its water is so low for 3 miles from Marianna down at extreme low water that boats cannot ascend at this time higher than a point 3 miles below town.

The time may come in the development of this country when the amount of commerce will warrant the erection of a lock and dam that will enable boats to run to Marianna the year round.

At present the amount of commerce will scarcely warrant the outlay.

No further appropriations are recommended at present.

Money statement.

July 1, 1885, amount available		$3,149 47
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$2,407 80	
July 1, 1886, outstanding liabilities	56 15	
		2,463 95
July 1, 1886, amount available		741 67

EXPENSE ACCOUNT, IMPROVING L'ANGUILLE RIVER, ARKANSAS.

Pay-rolls, labor, &c	$1,696 17
Subsistence supplies	417 34
General supplies	194 74
Traveling expenses	74 37
Fuel	22 00
Express and freight charges	70
Telegraph service	2 48
Total	2,407 80

U 9.

SURVEY OF ARKANSAS RIVER, ARKANSAS, FROM LITTLE ROCK TO ITS MOUTH.

The original plan for this survey contemplated covering the river with a series of triangles, determining the shore-line both at high and low water, the position of the bars and islands, the general topography of the valley to the bluffs when these are not too far from the river, the depth of the water, the gauging of the river at various points and principal tributaries, the nature of the soil and character of the river-bed, cross-sections to be made at frequent intervals, the slope to be accurately determined, and all other attainable data to be collected that will bear upon the problem of the permanent improvement of the navigation of the river.

There had been expended upon this project to June 30, 1885, $17,361.79, which had completed the field work practically and placed the maps in an advanced stage of completion.

During the fiscal year ending June 30, 1886, $1,627.01 has
pended in completing the maps.

The last clause in the summary in my last annual report c
understood in this connection unless the reader is careful t
mind that it refers to the entire river, though appearing under
of a survey from Little Rock to the mouth, as there are funds
there apparently, from the grammatical construction, to compl
under this special head, when really there were funds in han
purpose.

Money statement.

July 1, 1885, amount available ....
Received by sale of fuel to officer ....

July 1, 1886, amount expended during fiscal year, exclusive of liabilities
outstanding July 1, 1885 ....

July 1, 1886, amount available ....

EXPENSE ACCOUNT, SURVEY OF ARKANSAS RIVER, ARKANSAS.

Pay-rolls, labor, &c ....
Subsistence supplies ....
Travel expenses ....
Stationery supplies ....
Instruments ....
Fuel ....
Rent ....

Total ....

COMMERCIAL STATISTICS.

In reply to a letter sent to the Little Rock Board of Trade the following
received:

LITTLE ROCK BOARD OF TR
Little Rock, Ark., July

DEAR SIR: In reply to your request for information as to the region to b
by the proposed Arkansas River improvements, we desire to say that there
cial data whence to draw statistical information except that of the Uni
census of 1880.

The region to be benefited by the improvements embraces the richest la
the Mississippi River, "the center of maximum cotton production per a
rual soils in the United States, and probably in the world."

Twenty of the most populous and productive counties of the State of A
directly interested in this measure of river improvements. In 1880 these c
a population of 256,604, and produced 212,273 bales of cotton, and 7,000,000
grain, corn, oats, rye, wheat, &c.

The State increased in population during the last decade 65 per cent., in a
ble lands 84.5 per cent., and doubled her crop of cotton; so that in 188
stood fifth in total production and three in yield per acre among the cotton
States. The per cent. of increase has been maintained during the past
especially along the Arkansas River.

The commercial growth and prosperity of Fort Smith, Little Rock, and
the three largest cities in the valley of the Arkansas, demonstrate that t
300,000 industrious and deserving citizens are closely concerned in the im
of the Arkansas River and the securing of the needful appropriations fron
to carry out the plans you have made for widening and deepening the cha
river.

Over 200,000 tons will have its cost of transportation cheapened (the ra
ning parallel to the river in 1880 carried 111,735 tons) by the improvem
channel to secure an all-the-year-round water-way.

COMMERCIAL STATISTICS.

KENNETT, MO., *July* 5, 1886.

SIR: We, the undersigned citizens of Missouri, have the honor to state that, after careful investigation, we find the commerce of this section that will be benefited by the improvement of the Saint Francis River, between Lester's Landing and Saint Francis alone, may be determined by the following facts, based on actual figures obtained from each precinct in the county, and in localities seeking an outlet per river:

Fifteen acres cotton and 10,000 acres corn planted annually.

Seven thousand bales cotton, 25,000 bushels corn, and 3,500 tons cotton-seed produced annually; will be largely increased this year.

Five hundred tons merchandise, 600,000 staves, and 700,000 feet lumber shipped in last twelve months; both lumber and staves increasing.

Very truly, yours,

FULLER BALLARD.

Signed by:

W. F. SHELTON, merchant, Kennett, Mo.; T. E. BALDWIN, judge of probate and county treasurer, Kennett, Mo.; E. J. LANGDON, president of the county court, Kennett, Mo.; W. G. BRAGG, jr., clerk of the circuit court; D. P. PANKEY, clerk of county court; J. F. DONALDSON, sheriff and collector; J. D. THOMAS, director Transportation Company; C. A. PETTY, director Transportation Company; N. J. MCBRIDE, associate judge county court; JAMES M. DOUGLASS, justice of county court; ELI T. ANDERSON, physician and surgeon, Hornersville, Mo.; W. S. VAN DIVER, planter; JAMES B. HAYDEN, planter; S. L. PHILLIPS, merchant, Kennett, Mo.; S. S. WHITE, merchant, Kennett, Mo.; S. A. SAGE, justice peace, Kennett, Mo.; R. M. FINNEY, attorney, Kennett, Mo.; T. N. MCHANEY, notary public; A. B. MOBLEY, president Dunklin County Transportation Company.

H. S. TABER,
Captain, United States Corps of Engineers.

LETTER OF MR. Z. T. PURCELL.

GREENWAY, CLAY COUNTY, ARKANSAS, *June* 3, 1886.

SIR: Your letter of May 24 came duly to hand. I can only give you the approximate commerce of the Saint Francis, or the adjacent county of Saint Francis from the county line of Mississippi County, Arkansas, up to the crossing of the F. and St. L. Railway. The commerce is principally moved by wagons, but would go by river if it had the obstructions removed and those sloughs closed, as I wrote you last year, which could be done for four or five thousand dollars if intelligently and honestly applied.

The annexed figures are about the actual amount at present, and would be greater if there was any certainty of the transportation; especially the staves and lumber would be five times greater.

Since receiving your letter I have made inquiry and received the opinion of some of the best-posted men in this district, and the figures I give is the average; the value is price at railroad:

Lumber	$3,150,000
Staves	225,000
Cotton (10,000 bales)	450,000
Corn (600,000 bushels)	300,000
Pork	300,000
Potatoes (300,000 bushels)	100,000
Miscellaneous	300,000

It is stated at Saint Francis station that the commerce above the railroad is equal, if not greater. There is a little steamboat that runs from the railroad about 60 miles up.

I have no other facts concerning the river above at present.

Hoping this is satisfactory, I am, yours, &c.,

Z. T. PURCELL.

H. S. TABER,
Captain, United States Engineers.

with full plans and estimates for the improvement of t
Arkansas City, Kans., to Fort Gibson, Ind. T.

Money statement.

July 1, 1885, amount available ....
July 1, 1886, amount expended during fiscal year, exclusive of liabili
outstanding July 1, 1885..

Amount (estimated) required for completion of existing project...
Amount that can be profitably expended in fiscal year ending J
30, 1888...
Submitted in compliance with requirements of section 2 of river
harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

For commercial statistics, see the executive document referred
the report.

EXPENSE ACCOUNT FOR THE CONTINUATION OF THE SURVEY OF
FROM WICHITA, KANSAS, TO FORT GIBSON, INDIAN TERR

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Fuel...
Telegraph service..
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